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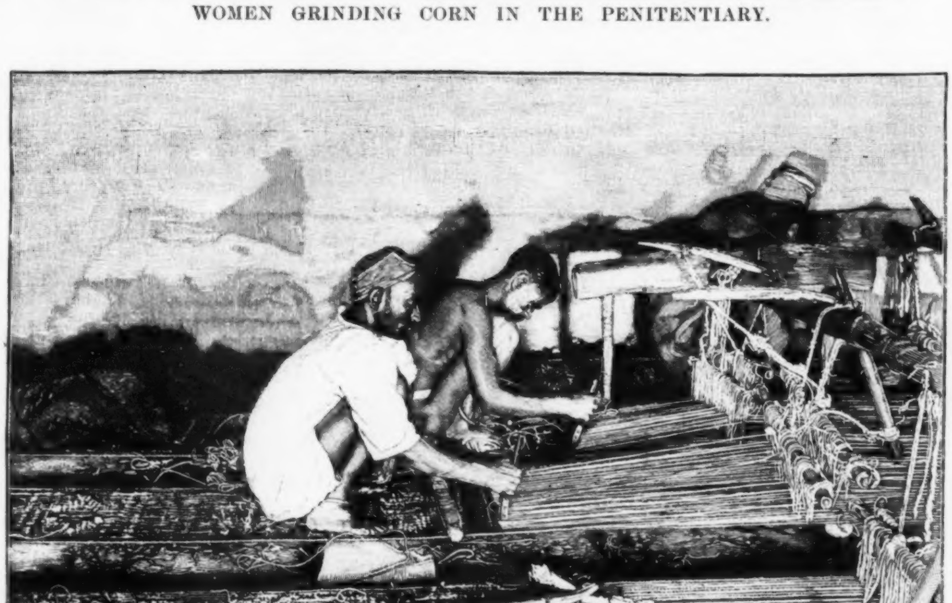
SCENES IN BENARES.

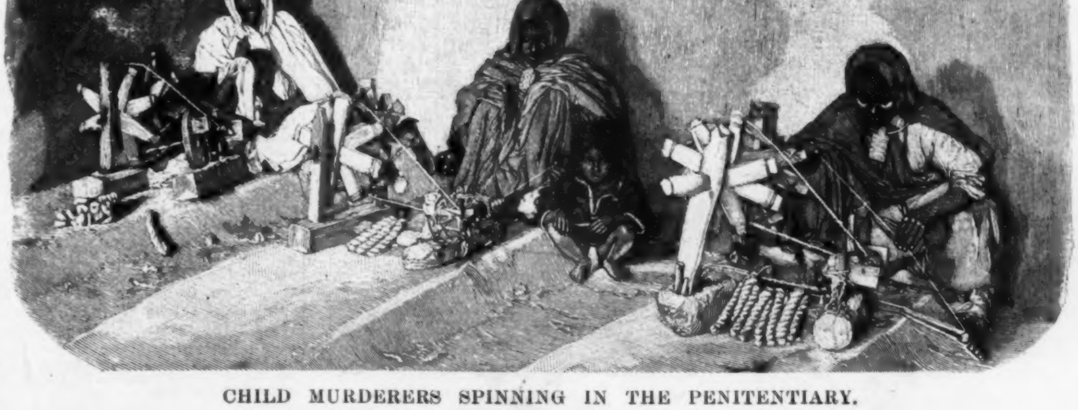
WE publish to-day reproductions of some instantaneous photographs taken by Dr. Boeck, of Dresden, during his last visit to Benares, that Mecca of the Hindu, so renowned for its fifteen hundred temples. This city is full of interest to any one who wishes to make a study of the customs of the natives, but he will probably find it difficult to penetrate the barrier they draw about themselves. The Hindu servants and guides will take a stranger about the city showing him temples and things of general interest until he is worn out, but they are seldom willing to introduce him to the real life of their people. If told that the visitor wishes to go to the Ganges early in the morning to see the bathers, they will find some excuse, such as not being able to get boats or boatmen; so that the traveler who finally reaches the sluggish, muddy river later in the day has no conception of the entire change in the physiognomy of the stream when seen in the delightful coolness of the early morning hours when only representatives of the highest classes, rajahs and Brahmins, bathe by the light of the moon or of dawn. Noble ladies and beautiful girls wrapped in light colored muslin stand in the Ganges and pour water over their limbs from their little bowls or "lotas," putting aside the custom of seclusion usually so carefully observed by women in Benares. Each hour brings a lower class of bathers, until only the lowest are seen upon the banks, and this is the time that the smiling guide chooses for showing the river to the European. It is the same with everything he wishes to see. In the temples he finds miserable beggars and Brahmins of low rank, but the doors of all the mysterious "nonns," cloisters and places where those who wish to hide from the Europeans seek refuge as penitents, are closed to him. One of the most interesting of these places is shown in one of our illustrations. This cloister is of historical importance as the hiding place of the last independent rajah who was driven from his palace in the last century by Warren Hastings. He felt safe here among the Shiva idols, the old lingams over which he so often piously poured the sacred water of the Ganges, milk and melted butter, as other penitents now do; for he knew that even Warren Hastings would not ignore the prohibition of the Brahmins by entering their religious retreats. In this "nonn" twelve days are passed in the worship of the lingam idols by Brahmins who are going from Benares as Sanyassis, or people who voluntarily leave behind them all their worldly property, all that adorns life, to spend the rest of their days under some distant sacred banyan tree as lonely hermits. One of these Sanyassis is shown at the right in the engraving. He will wander away from here to solitude clad only in a cotton cloth, an antelope skin over his shoulder to be used as a bed, a chain of seeds around his neck, on which to count his prayers, and in his hand his "lota." Those who belong to this sect are not allowed staffs until they are more than sixty years old.

Innumerable pilgrims are always traveling to Benares. Many who are sick or dying go there by railroad, in palanquins or ox carts, or on the backs of elephants or camels, so as to die near the sacred Ganges. Death has no terrors for the Hindu who knows that his ashes will be intrusted to the "eternal Mother Ganga." One needs strong nerves to visit the Munikurnika Ghat, or Burning Ghat, as the English call it, especially during epidemics, when hundreds are burned every day. If a Hindu dies in his house, he is wrapped in a shroud of white or yellow, with red spots, placed on a rough bier and carried out, not through a door, but through a hole that is made in the wall, and then immediately closed up again, so that the departed soul shall not find its way back to those that are left. The body is then carried to the bank of the Ganges and is often left where the river can wash it and the sun beat upon it, like the one shown in our engraving. It never occurs to a Hindu that this sacred river can carry contagion. If the sick man dies close by the Ganges, a handful of mud from the river is pressed on the blanching lips, then the body is placed on the bier, dipped in the Ganges and finally packed in the pile of wood or dried cow manure. In building the piles, four strong posts about five feet high are driven firmly in the ground and the pile erected between them, so as to prevent its falling apart when burning. When half of the pile has been laid, the body is placed upon it, the relatives and friends scattering pieces of sandalwood over the body, and then the pile is completed. Then the chief mourner, who must be the son of the deceased, or, in case of the absence of the son, his father or brother, walks three times around the pile and fires it with a sweet-smelling torch of sandalwood. After performing this ceremony, he withdraws to have his hair cut. Our engraving shows the chief mourner and the barber on the steps a little above the funeral pyre. After having given expression to his grief

WOMEN GRINDING CORN IN THE PENITENTIARY.



CARPET WEAVERS IN THE PENITENTIARY.



CHILD MURDERERS SPINNING IN THE PENITENTIARY.

in this manner, he joins the other relatives and together they wait for the body to be reduced to ashes, which are then collected in an earthenware jar and consigned to the Ganges.

The multitudes that flock to Benares from all parts of India are taught that they must respect the English laws or be sent to the central jail or the district jail. These jails are superintended by Europeans who are assisted in the performance of their duties by well behaved convicts. The prisoners have to work at the potter's wheel, in the kitchen, as painters or as blacksmiths, or at other occupations, according to their caste. One of our illustrations shows carpet weavers working in their old fashioned way, drawing the weft threads with their toes while their hands are otherwise employed. It is surprising to see how carefully the English respect the caste privileges even here in the prison. The Brahmins are not only allowed to keep by themselves while at work, but their food is cooked separately by cooks of their own caste. If a Brahmin is to receive a whipping, the cat-o'-nine-tails is used upon him only by a fellow prisoner of equally high caste. Another engraving shows a prisoner leaving his cell to be executed. He was a chief captured in the war against Burma and he defended himself against a keeper who was torturing him—a capital offense!

One of our engravings shows women grinding corn in the prison. Some of these women are clad in white and some in yellow, the latter color indicating that their crimes are serious enough to merit transportation and that they will be carried by the next transport to the Andaman Islands. Each of the women wears around her neck a steel ring to which is attached a wooden pendant bearing the record of her crime and stating the length of time she is to be imprisoned. In the neighboring spinning room there was, when the photograph was taken, a woman dressed in yellow who was to be taken to the islands the next day, because she had killed her two little daughters. The authorities had shown her the questionable kindness of allowing her little son to spend a few hours with her before her departure. Superstition and the inexorable laws of caste made a criminal of this woman. Her caste required her to celebrate the marriage of each daughter with a display far beyond her means, and superstition told her that she would be doing a good deed if she sacrificed the little girls to the elephant-headed god Ganesch, and that as a recompense these two girls would be born again to her as boys; so they were put in a kettle of boiling milk before the picture of this god. Formerly large sums of money were given to Brahmins to induce them to assist in this way in reducing the number of women, which was undesirably large.

It is pleasant to turn from all this misery to the beautiful poppy fields, which are such a rest to the eyes after having looked for a length of time upon the blinding yellow walls of the prisons. The region most celebrated for the cultivation of the poppy and the manufacture of opium lies between Benares and Ghazipur. Our engraving shows a woman cutting the green poppy heads, for which purpose she uses a knife consisting of five blades bound together, while the man who follows her catches the juice in an iron ladle. The overseer watches carefully to make sure that none of the valuable fluid is purloined. Even the water used in washing the wooden moulds in which the cakes are pressed is boiled down, so as to save even the diluted opium.

Dr. Boeck completed his collection of pictures by taking one of himself and the men who served his supper at the Dak Bungalow, where European travelers usually stop. He had proposed before to take their pictures, but, as Mussulmans, they were bound to respect Mohammed's law prohibiting portraits (waiters are always Mohammedans), and therefore refused to sit for him. Now he decided to take an instantaneous picture without their knowledge. While they were preparing the meal he arranged the camera, the flashlights were lighted at the proper time, and their pictures were taken with his own.

For the accompanying engravings and the above details we are indebted to Ueber Land und Meer.

BURMAN CHIEF GOING TO EXECUTION.

OPIUM HARVEST.

A GREAT SOUTH AMERICAN WATER SYSTEM.*

As is well known, the trade winds sweep along the equatorial belt across the Atlantic Ocean from east to west at stated and well-defined periods of the year. On encountering the South American continent they are not detained in their course, as the land is low and extends westward in vast expanses of plains not unlike the Russian steppes or the pampas that form the territory of the Argentine and the other republics that lie toward the extreme south of the continent.

The course of these trade winds is only stopped by the mighty Cordillera of the Andes, which runs along the whole of the South American continent, not far from the coast of the Pacific Ocean. It is on the summit of these mountains that all the moisture gathered by the winds during their long flight is deposited. In some parts the height is such that, notwithstanding the fact that the locality lies in the very heart of the tropics, the moisture crystallizes into snow and melts slowly. In other altitudes it condenses into water and flows downward, forming a series of torrents and streams which precipitate themselves along the mountain flanks, seeking the lower levels.

Two great water systems are thus formed, one toward the south of the equator—that of the Amazon—and another some degrees to the north, and above the equator—that of the Orinoco; the first one the largest river in the world, and the other the third largest stream of water known, since it is only excelled in volume by the Amazon and by the Congo.

The Orinoco is to all intents and purposes an inland sea. Like the ocean, it has calms and tempests, and at times its waves lash with fury the sands and the rocks along its banks. It was first discovered by Columbus, who sailed across its mouth, but did not venture inland. Toward the fourth decade of the sixteenth century Diego de Ordaz entered the river, and after navigating its course for about twelve hundred miles, deviated into one of its most important tributaries, the River Meta, which he ascended until he found himself not far from the first spurs of the Cordillera which dart into the plains. Here he abandoned his ships and betook himself to the land, climbing the abrupt sides of the mountains, until he arrived at the vast plateau of Bogota, the seat of the empire of the Muiscas and the Chibchas, second only in its power and development among those found in the new world, after the discovery by Columbus, to those of the Aztecs and of the Incas in Mexico and Peru respectively. Here he encountered two other expeditions of Spaniards who had come, the one from the north, from the shores of the Atlantic, and the other from the south, having entered the continent by the Pacific coast, all in quest of gold, searching for that

* Contributed by Senor Don Santiago Perez Triana, who has lately returned from a canoe voyage on the Orinoco, and published in the Journal of the Society of Arts.

famous Eldorado which lured the conquerors of the new world from one region to another and from one zone to a more remote one.

The aspect of the Orinoco, with very slight alterations to be found at places far distant from one another, remains the same as when the daring Spanish adventurers navigated its waters for the first time. Its course runs first from south to north until it encounters a low range of mountains, or rather hills, which deviate the stream into an easterly direction. A struggle of centuries must have taken place at this spot where, along a stretch of about thirty miles, the river is incased within very narrow limits, and rushes madly between the granite walls on either side, and plunging into deep and wide hollows, where the waters froth and bubble, and seem to rest prior to darting again through other and similar straight passages, and so on until they reach the open plains, and follow their course uninterrupted to the sea.

These rapids divide the river into two well defined parts—the Upper and the Lower Orinoco—and have acted as a barrier, which has kept the lands and the rivers beyond it almost unknown to and unexploited by man. One detail is worthy of mention, namely, that the rapids of the Orinoco are not due, as is the case of other great rivers, to a sudden and great descent of level; they are the result of the compression of an immense volume of water into a very narrow channel, studded with mighty rocks, which have withstood the onslaught of the waters, a channel along which the waters rush with extreme violence and rapidity.

The numerous tributaries that form themselves into the lordly current known as the Orinoco flow into it in all directions, from the north, from the south, from the east, and from the west. Most of them are navigable and receive other affluents, which in their turn are navigable also, so that the whole system constitutes a vast and prodigious network of rivers, carried deep into the very heart of the continent, to the foot of the mountains, and into the inmost recesses of the forests and plains. This network is, in truth, a complicated system of natural highways, which, were they placed longitudinally, would attain a length of many thousands and thousands of miles. Besides the running waters of the rivers, there are certain other water channels called caños, which connect some of the rivers with the others in a similar way to that obtained in other countries by means of artificial canals. Among these the caño of the Casi Quiare deserves special mention, as it connects the system of the Orinoco with the Rio Negro, which, in its turn, forms part of the Amazon system, so that those two great inland seas, the Orinoco and the Amazon, are united by these means.

Two well defined seasons divide the year in the vast valley through which the Orinoco tends its course—the wet season, lasting from May to November, and the dry season from November to May. The trade winds blow during the dry season and clear the atmosphere from the miasmas and exhalations of the soil, purifying it and rendering the climate cool and salubrious. Evidently the influence of population would tend to make these regions far more healthy and inhabitable than what they are to-day.

The forests abound in all sorts of natural wealth; precious timbers, medicinal and resinous plants, India rubber, and all the best known and most highly prized of the tropical products are found in exuberant abundance. The plains themselves are covered with natural grass, which affords the best kind of pasture, whereon the flocks thrive and multiply as rapidly as anywhere else on the surface of the globe; but little use is as yet made of all this immense supply of natural wealth. Along the Lower Orinoco there are some large cattle estates studded here and there, at immense distances from each other. On the shores of one of the largest tributaries, the Caura, and those of the Orinoco itself near the Caura, large forests of tonga bean—a species of aromatic almond used for medicinal purposes and for the preparation of perfumes—have been discovered and exploited for quite a number of years. Some few attempts at exploiting the rubber forests have been made with fairly good results, but this may be said to constitute all the work thus far done toward exploiting these regions.

The only city deserving that name which is found on the Orinoco is the old city of Angostura, now Ciudad Bolivar, named thus in memory of the liberator of the northern republics of South America. It was built by the Spaniards on a bluff overshadowing the river, 300 miles from its mouth, at a place where its waters are

LINGAM IDOLS AND PENITENTS.

THE BURNING GHAT ON THE GANGES.

PORTRAIT OF DR. BOECK IN THE DAK BUNGALOW.

encompassed within a very narrow strait, as the word Angostura indicates "narrowness." From this city steamers ply up the stream about every fortnight as far as the river Apure, two or three hundred miles to the west, and then turn into that river and up to the old city of San Fernando; and this is the sum total of the present navigation existing on the Orinoco, with the exception of the ocean steamers that penetrate into the river from the sea, and sail as far as Ciudad Bolivar.

The lonely traveler paddling along slowly in his canoe, or sailing along with the wind, when it is favorable, contemplates the exuberant natural wealth displayed on both shores of the river as they pass before his eyes, admires the magnitude of the numerous affluents that flow into the main stream from either side, and unconsciously forms the conviction that all these vast natural elements must necessarily be destined to form some day the basis of a mighty center of civilization and human industry, toward which end Nature has so lavishly contributed all her gifts, even to the facility of means of transportation, the highroads open to commerce, without which no people can attain greatness or large industrial and commercial development.

Beyond the rapids, that is to say on the Upper Orinoco, the forests are thicker, the affluents more numerous, and the climate healthier. Many tribes of Indians still remain scattered in those boundless regions. They are of a tame and peaceful disposition, and can be brought under the sway of civilization without any great effort or difficulty.

One special source of wealth attracts the eye of the traveler in the Upper Orinoco and its affluents. That is the abundance of rubber forests of identical quality to those which are to be found on the Upper Amazon. At the present day rubber forests are being sought for in all directions, and yet those of the Orinoco seem to be forgotten or ignored.

The republics of Colombia and Venezuela are the owners of the immense regions watered by the Orinoco. Little is known in either of them about this important part of their territory, and certainly no efforts are being made to obtain from it the products which it so abundantly offers. The problem of exploiting these vast regions is not one of difficult solution. A few steamers on the lower river, a few more on the upper and its numerous tributaries, and some sort of railway along the banks to connect the two parts of the river, facilitating the passing of the rapids, is all that is required. It is a work to be undertaken with the protection of the two governments, as from the moment that private individuals can be sure of the means of transportation, they would flock to those regions, where wealth can be obtained with more certainty and less danger than in the gold fields now and anon found in different parts of the world, to which thousands are attracted, and where so many hopes and so many lives are destroyed and lost.

It is to be hoped that this vast region will ere long attract the attention of those able to place it within the reach of modern industry and commerce. Energies that lie latent in the old world, and ambitions that are unsatisfied, would find on the Orinoco and its shores an ample and remunerative field.

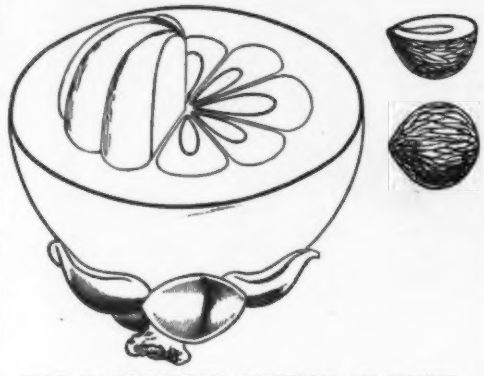
THE MANGOSTEEN.

Thanks to the courtesy of the authorities at Kew, we have been enabled to taste a ripe fruit of the mangosteen, grown in Trinidad, and sent home by Mr. Hart. The fruit is of the size of a small orange, leathery, purple, with a thick green four to five leaved calyx at the base, and a sessile four to five lobed stigma at the top, the stigmatic lobes long, club-shaped, flattened. Each seed is enveloped in a white or pinkish juicy pulp, which has a very delicate and agreeable flavor, though it does not here bear out the eulogistic verdict of travelers. The thick, leathery rind offers ample protection, so that its importation should be easy. In 1875 similar fruits were sent us by Mr. Prestoe, also from Trinidad.—Gardeners' Chronicle.

THE MANGOSTEEN (GARCINIA MANGOSTANA).

JAPANESE MUSHROOMS.

Mr. Robert P. Porter, who has been conducting investigations into the industries of Japan, states that one of the most interesting studies in that country is the growing of mushrooms in the Shikoku Island, where most of the camphor is produced. This is an important article of export, mostly to China, and during the year 1895, the last year for which the returns are available, the quantity of mushrooms exported from Japan to all countries amounted to 1,780,597 lb. Of the numerous species of edible mushrooms, the one called Shiitake is the most important, being abundantly exported abroad and also used for many culinary purposes at home. Logs which are used for cultivating this mushroom are various species of oak. The principal districts where this mushroom is produced are the provinces forming Shikoku, Kiushiu, Wakayama, and Shiozuka prefectures. Oak trees 25 to 33 years old are felled in the autumn, and incisions made with axes at intervals of 3 or 4 inches, the incisions generally reaching the woody layer. The trees are then cut into logs of 4 to 5 feet in length and left in dark secluded parts of the forest. After the third year, mushrooms make their appearance in the incised portions. When the growth lessens they are replaced by new logs. The mushroom grows at each season of the year, winter, spring, summer and autumn, but the growth in winter and spring is the result of artificial stimulus. The logs are steeped in water for a number of hours, according to the dryness of locality, and then struck with pommels or axes to prepare the beds for facilitating the growth of the mushrooms. The autumn crop is the most abundant. After being collected, mushrooms are dried either by the sun or by artificial heat.—Journal of the Society of Arts.



THE MANGOSTEEN—SECTION OF FRUIT.

SCHOOLS OF AGRICULTURE IN ITALY.

Several agricultural schools have of late years sprung up in various parts of Italy, the most important in the Naples district, says Consul Neville-Rolfe, being that of Portici. The school has been in existence about 24 years, having been originally established by the province, but it was taken over by the state, and re-established by royal charter in 1885. A portion of the disused Royal Palace was given over to its use, the spacious grounds, gardens, and useful group of farm buildings being especially adapted to that purpose. The instruction is conducted by sixteen professors, each of whom takes his own branch of the subject, as chemistry, botany, horticulture, zoology, entomology, geology, farm accounts, meteorology, physics, forestry, irrigation, etc., and lectures upon it. The course occupies three years, after which students who satisfy the examiners obtain the degree of Laureato Agronomo, or bachelor of agriculture. Besides the lectures, practical instruction is given in the field, and the making of cheese, wine and oil is systematically carried on. It is, in short, an agricultural university; 670 scholars have passed through the school, of whom 228 have obtained degrees, and there are 21 freshmen inscribed for the coming year. Most of the laureates become professors in other colleges in Italy, and some have gone to other places, such as Cairo, Buenos Ayres, and San Francisco. One very useful branch of the institution is the exhibition of agricultural machinery, upon which the future of Italian husbandry depends so much, and another the dissemination of pamphlets by the various professors on their special subjects. Of these last there is a very interesting one by Professor Italo Giglioli, the head of the school, on the importation of Italian fruit into Great Britain. He begins by stating that the total importation of fruit into the British Isles has risen from £5,977,351, in 1880, to £7,287,566, in 1890, with a steady annual increase. Besides this, in 1890, nuts to the value of £622,936 were imported. In 1890, only 4 per cent. of the fruit imported into Great Britain came from her own colonies, and 8 per cent. from Italy, but the professor is strongly of opinion that while the colonies have increased their export to a very large extent, the next decennial period will show that Italy has not been idle, and that with more attention to cultivation, packing, and means of transport, the Italian fruit will obtain a more influential place in Great Britain, which is shown to be the most influential fruit market in the world.—Journal of the Society of Arts.

AGRICULTURAL POSSIBILITIES OF THE YUKON VALLEY.

No doubt many on this coast, says the Mining and Scientific Press, San Francisco, Cal., will be interested in a sketch of the agricultural possibilities of the great Alaskan valley, which is now so prominent in the minds of gold seekers. It is from a Minnesota man, and the California reader will of course remember that his standards of comparison are very different from those a Californian would employ. The following is from a correspondent residing in Faribault, Minnesota:

The Alaskan Winter.—The winters in the Yukon valley are not much different from those of northern Minnesota in their influence upon the white man. The cold is more prolonged and severe, but the extreme dryness of the air, in a large measure, offsets this difficulty, and a man who has labored outdoors through a northern Minnesota winter will not notice much difference in the cold of the two localities in its effect upon his constitution. On the Yukon there are frequent periods during the winter when a man must desist from all outdoor work, and the thermometer drops down to 70° below zero, but I have on several occasions seen the mercury go as low as 60° below zero in Minnesota. From this, it appears that the cold is not to be regarded as so great an obstacle of that region as it has usually been.

Area and Soils.—The Yukon valley is so vast in extent that it is difficult to realize its size, and a very large portion of it is identical with the Red River valley of Minnesota in formation and in soil. The upper terraces of that portion of the Yukon valley which lies below the point where the river makes its exit from the mountains are immense level tracts of deep, rich soil which are only slightly broken at long intervals. So level, indeed, are these flats that the eye can seldom detect any change in the surface on them, and a furrow twenty-five miles long might be turned in many places without a break. The Pacific Ocean exerts a profound influence on the climate of the valley, and the changes of the seasons are wonderfully abrupt and decisive. When the spring comes, the sudden disappearance of the ice and snow, and the bursting forth of green verdure, are all but magical. The quick growth of plant life, and the perfection it attains, are truly remarkable. But it seems to be fully accounted for when the conditions of soil and climate that exist in the valley are understood. During the summer the ground never entirely thaws out. The surface is quickly released from the frost to the depth of 4 to 10 feet, according to location and character of the soil, and this frozen state of the subsoil is the principal factor in the growth of plant life. The summer is one long day of three months' duration. The sun swings round in a circle and is above the horizon from twenty-one to twenty-four hours each day, so that, for this lengthy period, it never becomes dark, and the ground has no chance to chill; no frost falls, and the thermometer ranges from 90° upward in the sun during these three months.

Moisture and Crops.—Again, the dryness of the air renders this prolonged, excessive heat as easy for man to withstand as a 75° to 95° temperature in Minnesota. It is seldom that rain falls during this short but potent summer, and storms of wind and hail are unknown. But the more prolonged the drought and heat may be, the quicker and more perfect is the growth of all plant life present, and the wide valley is clothed in deepest green during these summer months. The secret of this is that an abundant supply of moisture is furnished by the frozen subsoil, that slowly thaws and steadily releases the water stored in it, which is brought to the surface through the channels of capillary evaporation. This moisture is but slightly above the freezing point when it is absorbed by the roots of the growing plants, and it must exert a highly beneficial influence by counteracting the fierce heat that steadily assails the surface of the ground. Under these peculiar conditions of the natural forces of nature it is easily realized that a number of our staple crops will succeed and reach perfection in the Yukon valley. Scotch Fife wheat produces enormous yields of the very highest grade of that grain, which has been proved, by test, to make the best class of patent fancy flour. Barley and oats, potatoes and roots of all sorts, and many of the garden vegetables, also reach surprising perfection. In the case of barley grown in the Yukon valley, the malt makers would likely find the very highest grade of grain for their use, which might soon take precedence throughout the world. The growing barley would not be subject to the vicissitudes it is in the States, and especially it would escape the injury from rains during harvest, and when standing in the shock, which lowers the quality of this grain more than any other.

Present State of Farming.—There are already a number of small farms in the valley which have been opened by disappointed gold seekers, and it is from the results secured on these that I have drawn my most trustworthy information. These farmers are reaping a rich harvest of dollars. The miners stand ready to pay high prices for vegetables, and even for grains, which they grind into coarse meal for bread. This is the golden side of the picture of prospective farm life in that semipolar region.

The Drawbacks.—But there is a darker side to life in that far northern country, which will likely appear to those used to the comforts of farm homes in the States as insurmountable. The long, cold winter, with its constant night of nearly three months, when the landscape is wrapped in deep gloom, and when only a faint flicker of twilight and the changing play of the aurora borealis shining on the white snow reflect a faint, uncertain light, is likely to give a dubious aspect to the Yukon country. This dismal and dangerous period of the year, coupled with the incredible swarms of mosquitoes and flies in the summer, which make it impossible for horses or cattle to exist, seems to outweigh the favorable features of the valley. Mules and

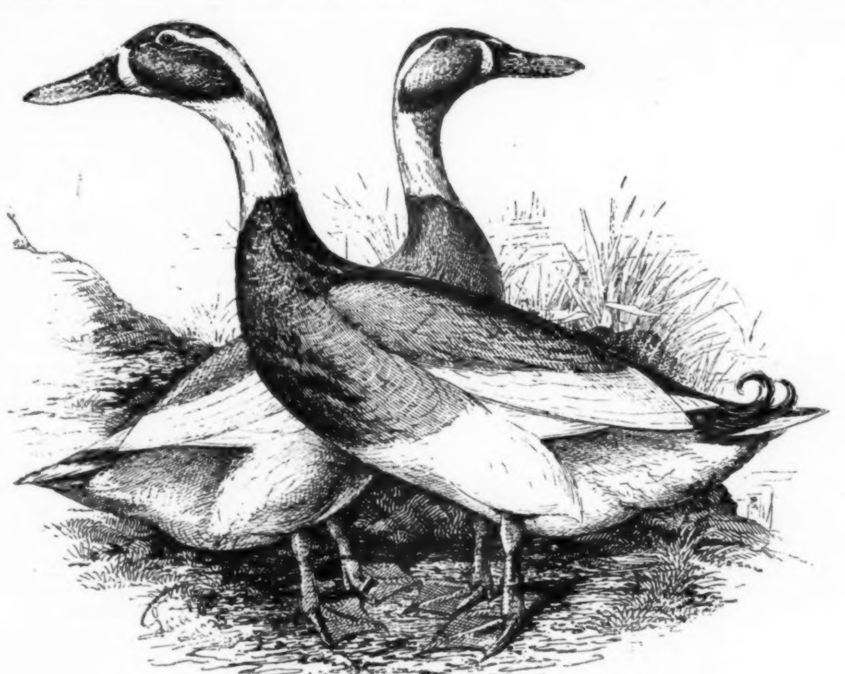
the reindeer will be the beasts of burden in that country if it be ever brought under cultivation. Sheep and hogs will, no doubt, be easily acclimated, and goats may take the place of the cow. The reindeer is a very valuable animal. It makes an excellent beast of burden, furnishes good meat, is easily reared, and is in its native home in that climate, and will take the place of the horse and the ox.

Anticipations.—If, however, a railroad should be built to connect the great Yukon valley with the commercial world, and wheat growing prove to be a profitable business there, the work would likely be done mostly by steam. There is plenty of coal in all districts of the valley, which will furnish cheap fuel for every purpose. On those great flats a traction engine can run a gang plow, turning furrows miles in length, and fields of 50,000 or more acres of wheat would likely be a common sight. The people could live in villages for mutual protection, and in the spring, summer and fall carry forward their farm work on the largest scale. Here the bonanza farm would find its true sphere, with room for all who wished to enter that class of business, and the great Yukon valley could be made to supply the marts of the world with the very highest grade of wheat that would, no doubt, command a better price than that of any other country. Neither are we to presume that this is a painting of the fancy. It will likely became a reality at no distant date.

INDIAN RUNNER DUCKS.

A VARIETY of duck has within the last few years attained a measure of popularity, known as the Indian runner; but has been bred for a long period—some claim for more than fifty years—in Cumberland and North Lancashire. It is a small bird, but the flesh is very good, and it is an abundant layer of medium sized eggs, having the further virtue of commencing to lay long before other ducks begin operations, which is an important consideration.

The evidence as to the origin of this duck is not very clear, but it appears to have come from India. Mr. J.



INDIAN RUNNER DUCKS.

Donald, who has done much to popularize the runner duck, says on this point: "A drake and trio of ducks were originally brought from India by a sea captain to Whitehaven, and presented to some friends, who at that time followed the occupation of farming in West Cumberland. Their extraordinary laying properties, producing a supply of eggs long before ordinary ducks commenced to lay, and continuing long after they had ceased, was sufficient to very strongly impress the economic mind of the Cumberland farmer, and for long they were exclusively in this one man's hands; but after their fame as layers extended, the drakes were eagerly sought after, and largely employed to cross the ordinary farmyard ducks of the country, with a view to improving their egg-producing qualities. Another consignment was imported by the same gentleman some years later, and from these two importations it is probable that all the present day runner ducks are either directly or indirectly descended. They were not known to their introducer by any special or distinctive name, having simply attracted his attention when ashore by their active habits and peculiar penguin carriage."

These birds are very active, excellent foragers, and specially useful in keeping down slugs and worms in gardens, obtaining a great portion of their food in this manner. They are, as already stated, remarkably good layers, which quality, combined with great vigor, is their chief claim to popular favor. The flesh is small in quantity, but excellent in flavor, and they do not fatten at all well. They are, as a rule, non-sitters, and when broody, which is seldom, are by no means reliable.

Quoting again from Mr. Donald, the following is that gentleman's description of the breed: Both drake and duck should be close and tightly feathered, with very erect carriage. Compared with other domestic ducks they are small, their average weight being from 3½ pounds to 4½ pounds each. They are alert and sprightly, with very active habits, nearly always being on the move. The head is fine and comparatively flat, with the eyes high up. The bill is very strong, at the base broad and long, coming straight down from the skull, giving it a wedge-shaped appearance. The neck is long and very fine, a character which is seen in its greatest perfection during the spring months, more especially in ducks when in full lay. The body is long and narrow, elevated in front, and the head carried high, giving a peculiar erect carriage when on the move; but the carriage is not so much of the penguin form now as formerly, and whether this effect is owing to climatic influences, the introduction of foreign blood into many strains, or to in-breeding, it is difficult to say with accuracy, but probably they have all shared to a greater or less degree in producing this effect.

The head of the duck is a faint grayish fawn and that of the drake a bronzy green, with a narrow band of white running round the base of the bill at its junction with the head in both duck and drake. The bill of the duck is a dull cucumber shade, while the drake has more of a yellowish green. The colored parts of the body of both drake and duck are of a soft fawn shade, that of the drake being finely penciled, and giving it a somewhat deeper reddish brown tinge toward the upper part of the breast, while the feathers of the duck have a brownish center to each feather, and a fine lacing of a lighter buff shade at the margin. The upper part of the tail and curl feathers of the drake is of a darker shade, somewhat resembling the color of his head. The legs in both duck and drake are orange red.

Hitherto the Indian runner has not been much used for crossing, but at the Royal Agricultural Show at Manchester, in June last, the first prize in cross breds were Aylesbury and runner cross, and they were splendid in quality, very fleshy, and only a few ounces in weight below the Aylesbury and Pekin cross. From this it would appear that the cross is better than we expected, and it is one which deserves further attention. —Edward Brown, F.L.S. We are indebted to the Gardeners' Magazine for t e cut and copy.

THE KLONDIKE PLACERS.*

WHEN the attention of the world was called to the new Canadian gold fields during the past summer, few people had ever heard of the Yukon placers. Nevertheless, prospecting has been carried on for over fifteen years throughout the whole length of the river, both in the northwestern territory of Canada and across the border in Alaska. The number of gold diggers at work tended to increase from year to year, but the severity of the climate and the difficulty of getting supplies into the country checked its progress, especially before 1892, when the first steamers were placed on the river by a trading company. In 1896 the total production of gold amounted to little more than £100,000, with about two thousand miners at work, and although some of this was produced on the Canadian side of the boundary, little attention was paid to it by the Geological Survey of the Dominion, and it was reported as if it were a part of the Alaska output.

On September 6, 1896, however, Mr. W. Ogilvie, the surveyor of the Yukon district, reported to the Canadian government that rich discoveries of gold had been made on Bonanza Creek, a tributary of the Klondike, which flows into the Yukon some fifty miles southeast of Fort Cudahy, where he was stationed, and about the same distance from the United States boundary. Mr. Ogilvie continued to make reports during the winter, and, from his book on the subject, lately published by the Dominion government, most of the following information is obtained. The discovery was made by G. W. Cormack, who had been in the country since 1887, and a rush from Cudahy at once took place, two hundred claims extending twenty miles along the creek being staked out within a fortnight of the time when the strike became known. Later on, when the neighboring creeks El Dorado, Hunker, Dry Fork and West Fork were found to promise well, the other diggings on the Yukon were almost entirely deserted. Miners traveled with sleds over the snow from Circle City and other places still farther off in United States territory, and by January, 1897, two thousand men were encamped on and around the Klondike, with scanty supplies and little protection against the cold, although a temperature of 50° below zero Fahrenheit was not unusual. Many men bought a share in the claims even as early as this for thousands of dollars, and the few laborers who preferred to work for hire received one and one-half dollars per hour, working as long as they liked.

Little gold was actually recovered in the winter, the "pay dirt" being dug out and piled up to wait until the spring, when the frost had gone and water was plentiful. Some extraordinary yields were announced, however, as the result of prospecting washings, two hundred and fifty dollars in a pan (containing about one-quarter of a cubic foot of gravel) being reported, but not generally believed. There is little doubt, however, that from one to ten dollars per pan was usually recovered in El Dorado and Bonanza Creeks, although the diggers, as is their wont, were very reticent.

In spite of this reticence and the lack of communication with the outside world, news of important discoveries leaked out, and in the early spring the rush into the Yukon basin from British Columbia and California was unprecedented. By May over two thousand people had entered the country by one route or another, and were pushing on to the Klondike, where the town lots of Dawson City had been staked out, and building was in progress. At the beginning of July the population of Dawson City had risen to five thousand, and more people kept coming in: but the supplies brought by them were far from being adequate, so that the scarcity of provisions continued almost unabated, and as the summer wore on became more and more pronounced, until it was evident that the seven thousand people who will be shut up there in the ensuing winter must suffer serious privations, if not absolute starvation, before the Yukon River becomes navigable again next spring.

Meanwhile, about July 15, the first miners from Klondike reached San Francisco, bringing with them about £400,000 in gold, and the excitement, which had been growing on the Pacific seaboard, became intense, and spread over the whole of the United States and Canada, and even reached England. Thousands of people started for the Yukon without sufficient supplies, and regardless of the fact that it was already too late in the season. Fortunately, the means of transport failed. The steamers on the Yukon were delayed, owing to the lowness of the water in the river; and the difficulty of transporting large quantities of stores over the passes leading from the seaboard to the interior prevented the southern route from being used by the majority of the emigrants, so that not one in ten of those who started late in the summer succeeded in reaching the Klondike, and starvation, if it comes, will not be largely due to the newspaper boom of July and August.

Turning from the history of the district to the description of the gold fields themselves, it may be remarked at once that the placers, which have caused so much excitement, do not present any very unusual features. The gravels are in general about 20 ft. thick, and, as usual, the parts immediately overlying the bed rock are the richest. The pay dirt is, however, said to be frequently 5 or 6 ft. thick, and about 30 ft. wide, the whole width of the creek beds varying from 100 ft. to 600 ft. or more. The gold is very coarse, and is, therefore, easy to save with crude washing appliances. It is of lower standard than most placer gold, containing only about 800 per 1,000 of gold, while the average fineness of Californian gold is about 880 and of Australian about 950. No very large nuggets have been found yet, the largest recorded being worth about £2 10s., and in this particular the placers resemble those of the Pacific coast generally, where large nuggets are very scarce.

Mr. Ogilvie considers that the auriferous gravels have been derived from the crystalline rocks lying to the south of the Klondike, between it and the Stewart River, which also contains gold, but no evidence has been brought forward as to their age. An interesting point in connection with the question of age is that the ground remains perennially frozen, only the surface being thawed in summer to the depth of two or three feet. It would appear, therefore, that, like the placers of Siberia, these deposits have remained undisturbed and unaltered ever since the glacial period, and perhaps some such evidence of this will, in course of time, be discovered as was afforded by the remains of mammoths and other animals in the Siberian frozen mud.

It is worthy of note that the comparative lowness of standard of the gold is, under the existing conditions, in favor of the view that the placer gold is derived from the erosion of auriferous quartz lodes formerly existing at a higher level, and has not been formed in situ by being deposited from solution. For, according to those who support the former view, placer gold becomes of higher standard than reef gold after it has found its way into the drifts, the base metals being gradually removed by the solvent action of running water, in which gold is not readily soluble. Since, however, the Klondike gold has been frozen up during a large part of the time since it was deposited in the gravel, it is obvious that it cannot have altered in composition so much as the gold in river sands further south, and might be expected to resemble the gold in the parent lodes, which is not usually more than 800 fine. The low standard of the gold is not so readily accounted for by the accretion theory of formation of placer gold. Some auriferous veins have already been discovered both in the creek valleys and on the mountains round them, although no direct evidence has yet been adduced to connect these lodes with the sources of the placer gold. Moreover, many nuggets have been found adhering to quartz, so that the weight of evidence appears to be in favor of the view that the gold in these placers, at any rate, has been laid down there by mechanical rather than chemical processes.

The method of working the placers resembles that followed in the frozen placers in the transbaikal in eastern Siberia. Prospecting is done chiefly in the short summer when the snows are gone and water is plentiful, but the excavation of the gravel is best carried on in winter, when nothing else can be done. The shafts are sunk to the pay dirt, and tunnels are then run through the gravel, following the rich material wherever it may be. To soften the ground a pile of wood is placed against the end of the drift and set on fire, the gravel, to the depth of about one foot, being brought down by pick and shovel after the fire has gone out. As M. Levat points out in speaking of the Siberian placers (Engineering and Mining Journal,

* From Nature.

June 12, 1897), the method is not an ideal one, but the circumstances are difficult. The frozen soil cannot be easily worked with the pick, as it does not break, but simply mats together under a blow. For the same reason powder and dynamite have little effect; moreover, the drilling of the alluvium through which quartz bowlders are scattered is a slow and costly work. The gravel is piled up to await the arrival of spring, when it is washed in the cradle or in short sluices, which are expensive, owing to the high cost of timber.

The future of the country can hardly be foreseen as yet. It is certain that next year hundreds of miles of unworked creek beds will be vigorously prospected by the thousands who will enter and find that all the ground on the tributaries of the Klondike is already occupied. If, as seems likely, other fairly rich placers are found, many of the men will remain in the country, and with the development of the auriferous quartz lodes and the beds of lignite, some of which have already been discovered, the Yukon district of Canada will probably become one of the steady producers of gold like California or Colorado. The output this year will probably not greatly exceed £800,000, partly owing to the scarcity of water in the creeks last summer, which interfered with the washing in the creeks. Nevertheless, the Canadian production of gold for 1897 will, with this addition, be raised to over £1,000,000, or considerably above that of 1863, which amounted to £860,000, and is still the highest on record. There is little doubt that this will be largely augmented in the next few years, and that the Yukon district will be the richest Canadian gold field yet discovered.

T. K. ROSE.

PALESTINE EXPLORATION.*

THE object of exploration is to obtain accurate knowledge of a country, its inhabitants and its extant monuments and texts. That of Palestine has special interest to Christian races and to Jews, as serving to explain more clearly the sacred literature of their faith.

The results of such exploration may be judged by looking back a century to the time of Bayle, Voltaire and Astruc, when what was regarded as advanced scientific work assumed that the Hebrews were a savage race without literature, that history only began to be written about 500 B. C., and that the oldest civilization was that of China and India. It is now known that the art of writing was practiced in Egypt and Chaldea as early as 3000 B. C., that the Canaanites, about the time of Joshua, had a civilization equal to that of surrounding nations, as had also the Hebrew kings; while, on the other hand, Chinese civilization is only traceable to about 800 B. C., and that of India was derived from the later Persians, Arabs and Greeks. These results are due solely to exploration.

The requirements for exploration demand a knowledge, not only of Syrian antiquities, but of those of neighboring nations. It is necessary to understand the scripts and languages in use, and to study the original records as well as the art and architecture of various ages and countries. Much of our information is derived from Egyptian and Assyrian records of conquest, as well as from the monuments of Palestine itself. As regards scripts, the earliest alphabetic texts date only from about 900 B. C., but previous to this period we have to deal with the cuneiform, the Egyptian, the Hittite and the Cypriote characters.

The explorer must know the history of the cuneiform from 2700 B. C. down to the Greek and Roman age, and the changes which occurred in the forms of some 550 characters originally hieroglyphics, but finally reduced to a rude alphabet by the Persians, and used not only in Babylonia and Assyria, but also as early as 1500 B. C. in Asia Minor, Syria, Armenia, Palestine and even by special scribes in Egypt. He should also be able to read the various Egyptian scripts—the 400 hieroglyphics of the monuments, the hieratic, or running hand of the papyri, and the later demotic. The Hittite characters are quite distinct, and number at least 130 characters, used in Syra and Asia Minor from 1500 B. C., or earlier, down to about 700 B. C. The study of these characters is in its infancy. The syllabary of Cyprus was a character derived from these Hittite hieroglyphics, and used by the Greeks about 300 B. C. It includes some fifty characters, and was probably the original system whence the Phenician alphabet was derived. As regards alphabets, the explorer must study the early Phenican and the Hebrew, Samaritan and Moabite, with the later Aramean branch of this alphabet, whence square Hebrew is derived. He must also know the Ionian alphabet, whence Greek and Roman characters arose, and the early Arab scripts—Palmyrene, Nabathean and Sabean, whence are derived the Syriac, Cufic, Arabic and Himyaritic alphabets.

As regards languages, the scholars of the last century had to deal only with Hebrew, Aramaic, Syriac, Coptic and Greek, but as the result of exploration we now deal with the Ancient Egyptian whence Coptic is derived, and with various languages in cuneiform script, including the Akkadian (resembling pure Turkish) and the allied dialects of Susa, Media, Armenia and of the Hittites; the Assyrian, the earliest and most elaborate of Semitic languages; and Aryan tongues, such as the Persian, the Vannic and the Lycian.

The art and architecture of Western Asia also furnish much information as to religious ideas, customs, dress and history, including inscribed seals and amulets, early coins and gems. The explorer must also study the remains of Greek, Roman, Arab and Crusader periods, in order to distinguish these from the earlier remains of the Canaanites, Phœnicians, Hebrews, Egyptians and Assyrians, as well as the art of the Jews and Gnostics about the Christian era, and the later pagan structures down to the fourth century A. D.

The monuments actually found in Palestine are few, though important. The discovery at Tell el Amarna of about 150 letters written by Phœnicians, Philistines and Amorites—and in one case by a Hittite prince—to the kings of Egypt proves, however, the use of cuneiform on clay tablets by the Syrians as early as 1500 B. C., and one such letter has been recovered in the ruins of Lachish. The oldest monuments referring to Syria and Palestine are found at Tell Loh, on the Lower Euphrates, and date from 2700 B. C. Next to these are the Karnak lists of Thotmes III, about 1600 B. C., recording the names of 119 towns in Palestine, conquered after the defeat of the Hittites at Megiddo. These lists show that the town names which occur in the Bible are mainly Canaanite, and were not of Hebrew origin. The Canaanite language of this period was practically the same as the Assyrian, excepting that of the Hittites, which was akin to the Akkadian.

In the next century the Tell el Amarna tablets show that the Canaanites had walled cities, temples, chariots and a fully developed native art. They record the defeat of the Egyptians in the north by Hittites and Amorites, and the invasion of the south by the Abiri, in whom Drs. Zimmern and Winckler recognize the Hebrews, the period coinciding with the Old Testament date for Joshua's conquest.

An inscription of Mineptah, discovered in 1896, speaks of the Israelites as already inhabiting Palestine about 1300 B. C., and agrees with the preceding. Other Egyptian records refer to the conquests of Rameses II in Galilee and in Syria, when the Hittites retained their independence; and in the time of Rehoboam, Shishak has left a list of his conquests of 133 towns in Palestine, including the names of many towns noticed in the Bible.

The Hittite texts found at Hamath, Carchemish and Merash, as well as in Asia Minor, belonged to temples and accompany sculptures of religious origin. They are still imperfectly understood, but the character of the languages, the Mongol origin of the people, and the equality of their civilization to that of their neighbors, have been established, while their history is recovered from Egyptian and Assyrian notices. The Amorites were a Semitic people akin to the Assyrians, and their language and civilization are known from their own records, while they are represented at Karnak with Semitic features.

The oldest alphabetic text is that of the Moabite stone about 900 B. C., found at Dibon, east of the Dead Sea, on a pillar of basalt, and recording the victories of King Mesha over the Hebrews, as mentioned in the Bible. Several Bible towns are noticed, with the name of King Omri, and the language, through approaching Hebrew very closely, gives us a Moabite dialect akin to the Syrian, which is preserved in texts at Samalla, in the extreme north of Syria, dating from 800 B. C. The Phœnician inscriptions found at Jaffa, Acre, Tyre, Sidon, Gebal and in Cyprus, do not date earlier than 600 B. C., and show us a distinct dialect less like Hebrew than the Moabite. The most important of these early texts is the Siloam inscription in the rock-cut aqueduct above the pool, found by a Jewish boy in 1880. It refers only to the cutting of the aqueduct (in the time of Hezekiah), but it gives us the alphabet of the Hebrews and a language the same as that of Isaiah's contemporary writings. It is the only true Hebrew record yet found on monuments, and confirms the Old Testament account of Hezekiah's work.

The Assyrian records refer to the capture of Damascus by Tiglath Pileser III, in 732 B. C., and of Samaria in 722 B. C., as well as to Sennacherib's attack on Jerusalem in 702 B. C. The latter record witnesses also the civilization of the Hebrews under Hezekiah, whose name occurs as well as those of Jehu, Azariah, Menahem, Ahaz, Pekah and Hosea, who, with Manasseh, gave tribute to Assyrian kings.

About the Christian era Greek texts occur in Palestine, the most important being that of Herod's Temple, at Jerusalem, forbidding strangers to enter, and those of Siah, in Bashan, where also Herod erected a temple to a pagan deity. Such texts are very numerous in Decapolis, where a Greek population appears to have settled in the time of Christ.

The geographical results of exploration are also important for critical purposes. Out of about 500 towns in Palestine noticed in the Old Testament, 400 retain their ancient names, and about 150 of these were unknown before the survey of the country in 1872–82. The result of these discoveries has been to show that the topography of the Bible is accurate, and that the writers must have had an intimate knowledge of the land.

Among the most interesting Old Testament sites may be mentioned Lachish, Debir, Megiddo, Mahanaim, Gezer and Adullam as newly identified; and of New Testament sites, Bethabara, Ænon and Sychar, all noticed in the fourth Gospel.

The existing Hebrew remains are few as compared with Roman, Arab and Norman ruins of later ages. They include tombs, aqueducts and fortress walls, with seals, weights and coins. The most important are the walls of the outer court of Herod's great temple at Jerusalem, with his palace at Herodium, and buildings at Cæsarea and Samaria. The curious semi-Greek palace of Hyrcanus, at Tyrus, in Gilead, dates from 176 B. C. In upper Galilee and east of Jordan there are many rude stone monuments—dolmens and standing stones—probably of Canaanite origin, as are the small bronze and pottery idols found in the ruins of Lachish. Sculptured bass-reliefs are, however, not found in Palestine proper, having been probably destroyed by the Hebrews.

This slight sketch may suffice to show the advance in knowledge due to exploration during the last thirty years. The result has been a great change in educated opinion as to the antiquity of civilization among the Hebrews and Jews, and as to the historic reliability of the Bible records. Further exploration, especially by excavation, may be expected to produce yet more interesting results, and deserves general support, as all classes of thinkers agree in the desirability of increasing actual knowledge of the past. It is no longer possible to regard the Hebrews as an ignorant and savage people, or to consider their sacred writings as belonging necessarily to the later times of subjection under the Persians. Internal criticism is checked and controlled by the results of exploration, and by the recovery of independent historical notices.

We are indebted to Nature for the above particulars.

* A discourse at the Royal Institution by Lieut.-Col. C. R. Conder.

German statistics for 1896 show that there died within the empire, immediately killed by boiler explosions, or within 48 hours of the accident, 20 persons, 2 were badly injured, and 13 slightly hurt. The causes were, in 8 cases insufficient water supply, brought about in 3 of these 8 cases by careless supervision, in 1 case inadequate material, in 2 cases local wear, and 1 case each was due to bad reparation, old fissures, worn material, over-pressure, sediment of mud and calcium sulphate.—Uhland's Wochenschrift.

SELECTED FORMULÆ.

Decolorizing or Bleaching Linseed Oil.—Bleached linseed oil may be prepared by everybody without much cost or trouble, says the Neue Deutsche Maler Zeitung, since only a little of it is required at best. If it is to be done by the aid of chemical bodies, the process of oxidizing or bleaching is best performed by means of peroxide of hydrogen, a clear liquid of siruplike consistency. For this purpose, the linseed oil to be bleached is mixed with 5 per cent. peroxide of hydrogen in a tin or glass bottle, and the mixture is shaken well repeatedly. After a few days have elapsed the linseed oil is entirely bleached and clarified, so that it can be poured off from the peroxide of hydrogen, which has been reduced to oxide of hydrogen, i. e., water, by the process of oxidation. The use of another oxidizing medium, such as chloride of lime and hydrochloric acid or bichromate of calcium and sulphuric acid, etc., cannot be recommended to the layman, as the operation requires more care and is not without danger. If there is no hurry about the preparation of bleached linseed oil, sun bleaching seems to be the most recommendable method. For this only a glass bottle is required, or, better still, a flat glass dish, of any shape, which can be covered with a protruding piece of glass. For the admission of air, lay some sticks of wood over the dish and the glass on top. The thinner the layer of linseed oil, the quicker will be the oxidation process. It is, of course, necessary to place the vessel in such a manner that it is exposed to the rays of the sun for many hours daily.

Carbon Paper.—Melt 10 parts lard, 1 part of wax, and mix with a sufficient quantity of fine lampblack. Saturate unglazed paper with this, remove excess and press.

Coloring Gun Barrels.—Bluing Barrels.—The bluing of gun barrels is effected by heating evenly in a muffle until the desired blue color is raised, the barrel being first made clean and bright with emery cloth, leaving no marks of grease or dirt upon the metal when the bluing takes place, and then allow to cool in the air. It requires considerable experience to obtain an even clear blue. Browning Guns.—The following recipe for browning is from the United States Ordnance Manual: Spirits of wine, 1½ ounce; tincture of iron, 1½ ounce; corrosive sublimate, 1½ ounce; sweet spirits of niter, 1½ ounce; blue vitriol, 1 ounce; nitric acid, ¾ ounce. Mix and dissolve in 1 quart of warm water and keep in a glass jar. Clean the barrel well with caustic soda water to remove grease or oil. Then clean the surface of all stains and marks by emery paper or cloth, so as to produce an even, bright surface for the acid to act upon, and one without finger marks. Stop the bore and vent with wooden plugs. Then apply the mixture to every part with a sponge or rag, and expose to the air for twenty-four hours, when the loose rust should be rubbed off with a steel scratch brush. Use the mixture and the scratch brush twice, and more if necessary, and finally wash in boiling water, dry quickly, and wipe with linseed oil or varnish with shellac.

Enamel for Copper Cooking Vessels.—To enamel copper cooking vessels, white fluorspar is ground to a fine powder and strongly calcined with an equal volume of unburnt gypsum, at a light glowing heat, stirring diligently. Then grind the mixture to a paste with water, paint the vessel with it, using a brush, or pour in the paste like a glaze and dry the same. Increase the heat gradually and bring the vessels with the glass substance quickly into strong heat, under a suitable covering or a mantle of burnt clay. The substance soon forms a white, opaque enamel, which adheres firmly to the copper. It can stand pretty hard knocks without cracking, is adapted for cooking purposes and not attacked by acid matters. If the glassy substance is desired to cling well and firmly to the copper, a sudden and severe heat must be observed.

Hektograph Sheets.—Soak 4 parts of best white glue in a mixture of 5 parts of water and 3 parts of solution of ammonia, until the glue is soft. Warm the mixture until the glue is dissolved and add 3 parts of granulated sugar and 8 parts of glycerine, stirring well and letting come to the boiling point. While hot, paint it upon white blotting paper with a broad copying brush, until the paper is thoroughly soaked and a thin coating remains on the surface. Allow it to dry for two or three days and it is then ready for use. An aniline ink should be used for writing, and before transferring to the blotting paper, wet the latter with a damped sponge and allow it to stand one or two minutes. Then proceed to make copies in the ordinary way. If the sheets are laid aside for two days, the old writing sinks in and does not require to be washed off.—Chem. and Drug.

Cigar Flavoring.—

(1) Macerate 2 ounces of cinnamon and 4 ounces of tonka beans, ground fine, in 1 quart of rum.

(2) Moisten ordinary cigars with a strong tincture of cascarilla, to which a little gum benzoin and storax may be added. Some persons add a small quantity of camphor, or oil of cloves or cassia.

(3) Tincture of valerian	4	drachms.
Butyric aldehyde	4	"
Nitrous ether	1	"
Tincture vanilla	2	"
Alcohol	5	ounces.
Water, enough to make	16	"

(4) The following formula was contributed to an exchange some years ago as one which was put up for cigar manufacturers:

Extract vanilla	4	ounces.
Alcohol, Jamaica rum, } of each	½	gallon.
Tincture valerian	8	ounces.
Caraway seed	2	"
English valerian root	2	"
Bitter orange peel	2	"
Tonka beans	4	drachms.
Myrrh	16	ounces.

Soak the myrrh for three days in 6 quarts of water (?) add the alcohol, tincture valerian and extract of vanilla, and after grinding the other ingredients to a coarse powder, put all together in a jug and macerate for two weeks, occasionally shaking; lastly, strain.—Pharmaceutical Era.

ENGINEERING NOTES.

Charles Parsons, the inventor of the steam turbine which was fitted in the 100 foot torpedo boat Turbinia, giving her a speed of 33 knots an hour, is about to construct at Newcastle-on-Tyne a vessel of the torpedo boat destroyer type with turbine engines. It is stated that she will have a speed of 36 to 40 knots an hour.

What is said to be the largest dredge ever built has lately been put together in Buffalo. It is 140 feet long, 40 feet wide, and 12 feet deep. The fifteen ton clamshell bucket will operate at a depth of 80 feet, forcing up 10 cubic yards of mud at once. The dredge is named Fin McCool (Finn MacCumhail), who, according to legend, was the strongest Irishman in the world.

For years the St. Gothard tunnel has been famous as the longest in the world, extending nearly nine and a half miles. The glory of this tunnel is about to depart, as the longest tunnel is about to be constructed in England. It is to be on the line of the London and Northwestern Railway Company, which has decided to bore through the steep incline known as Shapfall, with which travelers to Scotland are more or less familiar.

H and W. Pataky, of Berlin, have constructed a simple apparatus for arriving at a comparative idea of the value of a packing or lagging material. It is simply a gas pipe connected with a steam pipe, with valve and manometer. The pipe is provided with a discharge cock at its lower end. The pipe is coated with the material in question, and steam is admitted into it, the cock first being left open. After a while the cock is closed, the pipe is filled with steam, but the valve is not closed. The steam continues to circulate and to condense. The condensed water will finally reach a mark made on a water gage. From the period which has elapsed, the heat conductivity of the material can be estimated.

From some experiments on the pneumatic caissons of the new quays at Bordeaux, M. A. Pasqueau is of the opinion that it is possible for men to work under compressed air at a pressure of about 77 lb. per square inch, which is equivalent to about 170 ft. sea water, but for this depth the pressure should not be reduced at a quicker rate than 10 minutes to about 1½ lb. He also recommends that the chamber in which work is being done should be warmed to from 68 to 86 deg. Fahr.; that the air lock should be supplied with fresh air during the time the pressure is being let down; that no valves controlling air should be manipulated by the workmen; and that in order to lessen fatigue the men should be brought to the surface by mechanical lifts.

A mass of copper and silver ore weighing 3,567 pounds, from the great Anaconda copper mine of Butte, Mont., has been presented by H. B. Parsons, vice-president of the Anaconda Copper Mining Company, to the Museum of the Brooklyn Institute of Arts and Sciences. The big chunk of ore was carted from the office of Wells, Fargo & Company, 63 Broadway, recently, to Brooklyn, a crowd gathering in the street while it was being removed from the express office. The mass contains, per assay, 75·04 per cent. of pure copper and pure silver at the ratio of 50·05 ounces to the ton. The metal in it is worth $375. It is the second largest mass of Anaconda ore ever brought east, one piece weighing 5,000 pounds having been sent to the Chicago World's Fair. Its donor, Mr. Parsons, is a trustee of the Brooklyn Institute.

A New York-Chicago limited train, consisting of seven cars, has just been turned out of the shops of the Wagner Palace Car Company, and will shortly be put in operation by the New York Central & Hudson River Railroad, says Engineering News. The train will make the trip between Chicago and New York in twenty-four hours, and will be known as the New Lake Shore Limited. It consists of a buffet smoking car, a dining car, a drawing room car, three sleeping cars and a compartment observation car. The cars are connected by wide vestibules, and have Pintsch gas ceiling lights and electric berth lights, the electric lighting system adopted being the Gibbs. The baggage room of the buffet smoking car contains the 30 horse power Westinghouse engine and dynamo for electric lighting. The train is luxuriously equipped throughout, having bath, barber shop, library, waiting room, stenographers' and typewriters' service, the latter being free, besides the usual conveniences and comforts of the regular Wagner car service. Perhaps the most distinctive features of the train as a whole are the provisions made for persons or parties designing to travel as privately as possible, there being private state rooms, private dining rooms, etc., with separate wash rooms and toilet conveniences. In the interior the cars exhibit a variety of styles of decoration, but on the outside all are alike, being the regular Wagner palace car color, sparingly decorated with gold leaf.

A plan is being perfected by the navy department for the establishment of a complete system of signal stations along the Atlantic coast, by which ships of the navy passing near the shore may receive messages from and send them to Washington authorities. Such a system has been in operation abroad, and has performed valuable service for the navy. It is intended to use, when practicable, the life saving stations for signal towers, and where such stations are not well located new ones are to be established for the exclusive use of the signal service. A board has been appointed by Secretary Long to report a practicable measure. This board consists of Commander Schouler, Lieut. Gibbons, Lieut. Harlow, and Lieut. Anderson of the New York Naval Militia, and has been in session several days. Along the Long Island shore, and at other points where the life saving service cannot be utilized for the new scheme, stations will be placed in charge of members of the State militia, which will have entire charge of the system in time of war. Communication from one station to another will be had by telephone and telegraph, so that it will be possible for the movements of a fleet sailing well inshore to be kept in touch with the entire system. It is probable that the government will have a special line of wire to Washington, in order that it may be kept in prompt communication with the signal stations, when necessary. For years Great Britain, France, and other European powers have used a like system extensively, and with a chain of life saving stations extending from Maine to Florida it will not be difficult for the navy to apply it here.

ELECTRICAL NOTES.

It has been suggested to use a new unit of length for very great distances, such as those in astronomy, over which an electrical impulse could be sent in one second: it is assumed that in one second a current impulse would travel seven times around the earth. According to this it is stated by an Austrian contemporary, says The Electrical World, that a message could be sent to the moon in one second, while it would take eight minutes to reach the sun. The nearest star would receive a message after four years. There are fixed stars which are still visible which to-day would not have received the news of the discovery of America, while there are still others at which the news of the birth of Christ would not have been received.

In 1869 there were sent in Belgium 1,722,586 commercial telegrams and 315,722 telegrams relating to the service of the telegraph, which required no toll. The receipts amounted to 1,323,000 francs. The Hughes printing telegraph instrument was then adopted, and, with some improvements, is still used. Ten years later multiple telegraphy was adopted upon commercial lines and has since grown so that upon all wires this rapid system is used more or less. A report made at the close of the year 1894 shows for Belgium alone 54,740 kilometers of wire, including the telephone service of 23,236 kilometers. Private line wires in 1895 were 58,078 kilometers. Upon these lines of telegraph there were used 1,806 instruments, employing 8,739 people.

It has long been held from practical experience that the network of wires now found in many towns protects those places from the effects of lightning, and probably also prevents many thunderstorms from breaking over them. An official inquiry has been recently made in Germany as to the influence exerted by telephone wires on atmospheric electricity, with a view to set at rest the question whether danger from lightning stroke is increased or diminished by a close network of wires. The inquiry has shown that the wires tend to weaken the violence and diminish the danger of lightning stroke. Returns obtained from three hundred and forty towns provided, and from five hundred and sixty not provided with a telephone system, show that the danger varies in the proportion of 1 to 4·6 between the two cases.—Invention.

A table taken from the annual reports of the Railroad Commissioners of New York and Massachusetts for nearly all of the street railway properties shows the cost of the electric power required to run a car one mile under average conditions of load, etc. The table gives, says The Street Railway Journal, the number of cars owned, the car mileage per year and the cost of the electric power per mile and per passenger. Of the nineteen companies operating less than two hundred and fifty thousand car miles, four are obtaining power at a cost of less than 2 cents per car, six between 2 and 3 cents, five between 3 and 4 cents, one between 4 and 5 cents, and three at more than 5 cents; of the five companies operating over five million car miles per year, one obtains the power at less than 1 cent per car mile, three between 1 and 2 cents, and one between 2 and 3 cents; other similar figures are also given between these limits. The Brooklyn Heights Company has the cheapest power, 0·86 per car mile, followed by the Binghamton, with 0·94; the cost of power for Massachusetts roads includes repairs and depreciation of the station plant, which is not the case of the New York roads.

The chief idea underlying the proposal which Bochet has made in the Société Internationale des Electriciens is not strikingly novel, and all will depend upon the details of his device. We remember several patents concerning contacts exposed at the height of the cars for long conductor strips fixed on one side of the top of the cars in such a way that the conductor is always in contact with one of the terminals. Le Génie Civil, which reports upon Bochet's paper, illustrates one of his proposals, which fixes the contacts to short brackets attached to the lamp posts. Two cars are shown joined in order to get a greater length for the conductor above. That will not always be possible, and to place poles at distances of less than the length of an ordinary train car apart does not look very hopeful either. There must be considerable difficulties in carrying out projects of such apparent simplicity. Otherwise the trolley would have had to go, for the objections to the trolley remain strong. In some parts of Berlin, where the buzzing aerial conductors were not to be tolerated, short conduit sections have been tried during the last months. But all sorts of things, as we see from a paper by Fischer-Dick, in Glaser's Annalen, children's iron hoops among them, got into the slot, and the contact plows showed the severe wear very distinctly.

A very clever mail delivery box has been placed in a number of the larger buildings at Geneva, Switzerland, by an enterprising electrician, says The Electrical Engineer. This mail box has a compartment for each of the stories of the building, and when the letters are deposited on the ground floor the carrier delivers them as required. The deposit of a single letter makes an electric contact, which starts a bell going on the respective floor, which does not cease ringing until the letter is taken out. At the same time it opens the faucet of a tank on the roof of the house, which causes water to flow into the cylinder forming the counterweight of the mail box elevator until the weight is heavier than the box, when the box ascends and the flow of water ceases simultaneously. As the box passes each story, the mail intended for it—letters, papers and small packages—falls into boxes in the corridor on that floor. This is performed very reliably by a little spring at the bottom of each compartment in the elevator mail box, which causes the bottom of the compartment to catch for a moment, and the release throws out even a single piece of paper thinner than a postal card into the stationary box provided for its reception. When the box has passed the uppermost floor, the cylinder filled with water strikes a bolt provided at the bottom, which allows the water to flow out, and by its own weight the box descends to its place on the ground floor. Should by any mischance a single piece of paper have remained in the elevator, upon striking the bottom it will at once go through the same series of movements as before.

MISCELLANEOUS NOTES.

Over 140,000 persons traveled through Switzerland in government post chaises and diligences last year. Of these 77,736 went into the Engadine by the Schyn Julier, Albula, Fluela, and Bernina passes; 14,616 were transported over the Ober Alp; 14,173 over the Splugen; 8,676 over the Bernardin; and 7,502 over the Simplon.

A publication has been issued by William T. Lewis, president of the Philadelphia Horological Society, on the lubrication of watches, chronometers and clocks. In these few pages he emphasizes the fact, among others, that even the best made watch cannot keep accurate time from year to year unless lubricated with the finest quality of oil. Among the sources of lubricants for this purpose mention is made of porpoise jaw oil and blackfish "melon" oil as having become widely and justly celebrated in all parts of the world for lubricating fine and delicate machinery. The blackfish melon oil derives its name from the mass from which it is extracted, taken from the top of the head of the blackfish, reaching from the spout hole to the end of the nose and from the top of the head down to the upper jaw.

According to a recent paper by Mr. Corbet Woodall, the cost of carbureted water gas in England is determined chiefly by the price at which oil can be bought. The sources of supply are the wells of Russia and America, and also, though to a small extent only, the shale oil works of Scotland. At present suitable oil can be purchased at 5 cents per gallon at English ports, which represents about 5·5 cents at the average gas works. Gas of an illuminating value of 20 candles will require 3 gallons of oil per 1,000 cubic feet, and 40 pounds of coke will also be used in making that quantity. The cost of making gas of 20 candle power, with oil at 5·5 cents per gallon and coke at $3.60 per ton, will be 32 cents per 1,000 feet in the gasholders. This is about the same as the current average cost of making coal gas of 15 candles.

In a recent lecture by Prof. A. H. Sabin in Brooklyn, N. Y., on the corrosion of iron and steel, the fact was noted of iron lying in the ground 1,000 years and being dug up in a fairly well preserved condition; while, on the other hand, modern water pipes which have been underground only a few years have been found badly rust eaten, and in Boston recently a thick cast iron water pipe was taken up and sections of it had corrosive holes from the size of a walnut to that of an apple. Still further, this contrast between the former and later periods is seen in the fact that even in structures exposed but to the action of the air, the steel has been seen to decay in a comparatively short time, and steel beams have had to be frequently removed from buildings. Once the work of corrosion sets in, the progress of chemical decline is quick.

Cheap houses for workmen are being built in Leipsic by "The Society for Building Cheap Houses for Workmen." This society has already built 39 houses, valued at $387,216, and providing 361 lodgings for families and 38 for single persons. As the society only demands 3 per cent. returns on its capital, it rents houses on the following terms: Single rooms, $9.50 to $14.25 per annum; apartments of three rooms, from $31 to $38, and of four rooms, $36 to $47. A small garden costs 4 cents per week additional, and for 5 cents per day a child will be cared for, including its meals. Rent is payable weekly, and the deficit caused by delayed payments amounts to only 6 per cent. on the total receipts. No tenant is allowed to sublet rooms, and the proprietor must give a week's notice and the rentor three months' notice before changing.

We do not know that the town of Ludwigshafen, situated opposite Mannheim on the Rhine, has particularly suffered from fires, but we see that they have ordered a skeleton house with three rows of windows for fire brigade practice, and also for drying the fire hose. The iron structure consists of a ground floor in corrugated iron, and three stories of open angle iron work, rising to a height of 48 feet, and further overtopped by an iron pipe, 27 inches wide, extending to a height of 71 feet. This iron pipe, in which the hose is to be dried, does not reach down to the ground. The whole structure is to be fixed to any foundation, and can easily be taken to pieces and transported. Ludwigshafen is quite a modern industrial town. In 1840 not 100 souls were living on the spot; at present the many and varied works give employment to almost 40,000 people. The structure, which has three windows in each row, front and back, and two in each on the sides, is being built by W. Martin, of Marten, Westphalia. The order is somewhat unusual for a small town.

According to one writer of the modern school, the best way to dispose of broken china is a method that is not quite new, but one that is being revived. The result is almost pretty enough to console a housewife for the loss of her cherished china. This means of disposition requires a large number of broken pieces, the more and the smaller they are the better. The only accessories needed in the process of saving broken china are plentiful supplies of putty, a smooth surface like a board or a flower jar, and a bottle of gilding. There are two methods of procedure. One is to cover the board or jar with putty and pat it down smooth and even before beginning to stick on the broken pieces. This method is preferable if one has enough pieces to finish the whole surface at one sitting. If not, it is better to take a small lump of putty for each piece, fitting it down and putting the next one into place beside it, and so on until the surface is covered. The putty which oozes up between the pieces is then gilded, and the process, so far as the broken pieces are concerned, is over. So far, only the bare material for articles of use has been manufactured, but there is no end to the list of uses to which it may be put. Some women use it for picture frames, others for imitation tiling or mosaic. If one has a large supply of broken dishes, an ugly mantelshelf can be greatly beautified in this manner. It would require the savings of several families for this, however, and unless the mantel is very small, it is rather too ambitious an undertaking for a beginner. It may be mentioned that if putty is used for the purpose above indicated, it might be an improvement to adulterate it largely with white lead, as used by our grandmothers, and a still greater improvement might be to use plaster of Paris tempered with whiting.

GRAIN ELEVATOR IN COPENHAGEN.

THE imposing grain elevators and stores that have recently been erected in European seaports prove that the greatest attention is given, not only in the United States but also in Europe, to arrangements and apparatus relating to the storing of grain and to this branch of commerce, and as we think it may be of interest to some of our readers to see just how a building devoted to such purposes is arranged, we publish herewith engravings giving the elevation and cross section of the grain elevator of the Kjöbenhavns Frihavns Aktieselskab in Copenhagen. It stands on the end of a pier 187 ft. wide; the quays on each side are about 43 ft. wide and each of them is provided with railroad tracks that are connected at the ends by turntables and cross tracks.

A tunnel runs along the quay which is designed for the reception of pipes, electric cables, etc., and into this tunnel six cross tunnels open on each side, which contain twelve carrier belts that can be loaded from

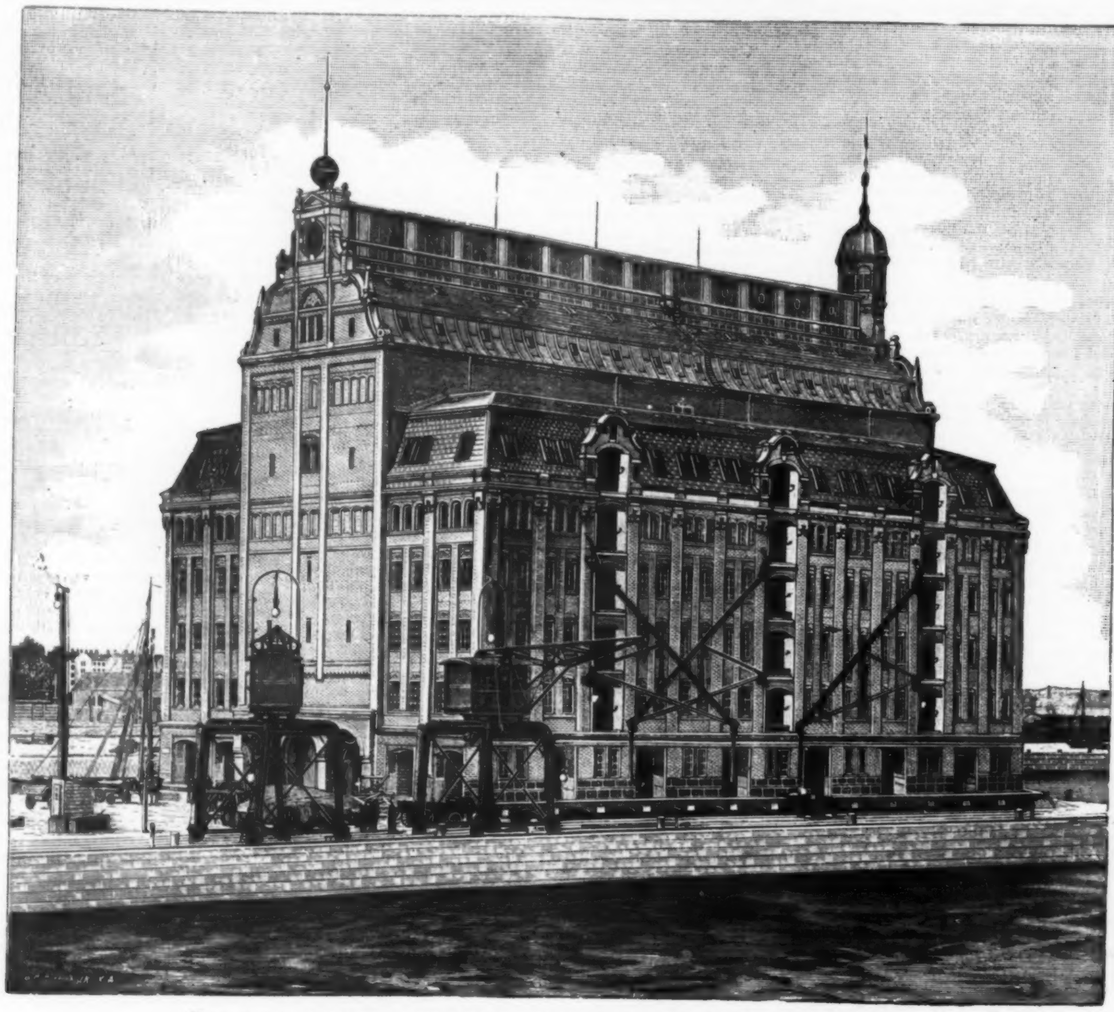


FIG. 1.—GRAIN STOREHOUSE AND ELEVATOR IN COPENHAGEN.

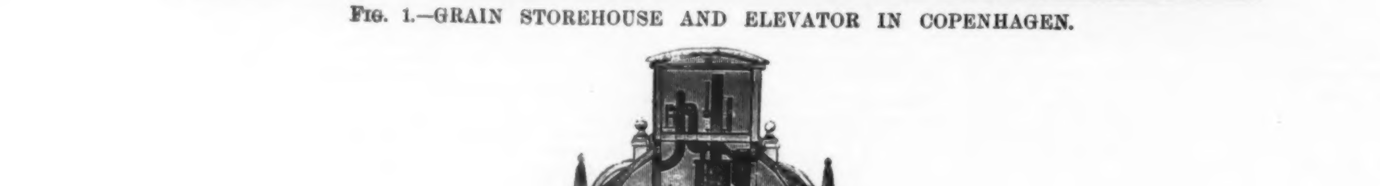


FIG. 2.—CROSS SECTION OF GRAIN ELEVATOR, SHOWING BINS.

openings in the main tunnel when the iron covering is removed.

The building is 170 ft. 7 in. long, 103 ft. 4 in. broad, 42 ft. 7 in. of which breadth is taken up by the bins, and 128 ft. high from the cellar floor to the roof. The bins, thirty-six in number, have a height of 65 ft. 7 in., a length of 15 ft. and a breadth of 12 ft. 5 in., and each one holds two hundred tons. The funnel-shaped floors are made of beton laid between I beams and rest on wrought iron pillars. At each center there is a pressure of 990,000 lb. The walls of the bins are made of boards secured to standards, only the outer walls of the two groups, each of which consists of eighteen bins, being fireproof. The rooms of the different stories, or lofts, are provided with double floors with a filling of sheets of asbestos on wooden beams, iron beams and pillars.

The elevators designed for unloading the grain from vessels have not yet been built, and so for the present it is raised by means of the hoisting devices of the vessel, which throw it into tubes that conduct it to the carrier belts. These belts consist of impregnated hemp, are 25½ in. wide, and with a speed of 6 ft. 6 in. can carry sixty to seventy tons per hour. As shown in Fig. 2, two belts work on one elevator, but only one at a time, of course, one being always cut out. The grain carried in by the belts is raised by elevators 131 ft. long, which have a velocity of 28 ft. and are capable of raising sixty to seventy tons per hour. They are provided with patent buckets 8½ in. wide and 4½ in. high. The lower part of the elevator is provided with tension devices; the upper part is made of iron, and the shafts of the elevator drums and the gearing rest on iron bearings. The wheels have a proportion of 1:4, so that the gearing makes 160 revolutions to 40 of the elevator shafts. The teeth of the wheels are cut. The further transmission to the electric motors is accomplished by means of belts. The space devoted to the machinery is fireproof and elegantly finished.

From the elevators the grain passes on two box scales, each of which weighs one ton at a time. One man takes charge of two scales. While one is being filled the other is tared and emptied by means of a lever on the box; then, by means of a second lever, the supply is admitted to the other box and this one is tared. Sixty boxes are weighed per hour; that is, one per minute. In order to avoid the terrible dust which arises when some kinds of grain are weighed, the scale holders are uncovered and air is sucked through the small opening, whereby the escape of the dust is prevented.

The weighed grain falls into a revoluble funnel or hopper, which conducts it to the next story or bin, or, if it is to be stored at a greater distance from the scales, it is conducted to the proper belt, which carries it to the desired place. Each belt has two deflectors which direct the grain to the right or left in the tubes or to the belt again. These deflectors are moved mechanically by chains, the movement of which is regulated by a pull on the guide rope. By means of this arrangement and the conducting tubes on the different stories the work is carried on; the grain is unloaded from the vessels, weighed, and stored in the desired bin or floor of the building. A similar arrangement serves for circulating the grain and loading the vessels.

If the grain is to be loaded on a vessel, the adjustable loading tubes are set in operation, and these, with the vertical hanging tubes, deliver the grain directly to the hold of the vessel. If this is to be reversed, the next tube is opened by turning a funnel-shaped head. At first the grain runs by its own weight through the tubes on the particular carrier belt and elevator, but later it is necessary to shovel it. When it is discharged from the elevator, it is subjected to a current of air which blows off the fine dust and chaff; then it passes through the adjustable funnels and the proper tubes, back to the desired floor. It is evident that the effect obtained by this ventilation is quite different from that obtained by the old hand turning on the different floors.

A cleaning machine is provided for the thorough cleaning and separation of the coarser parts.

All of these machines are driven by electricity from the central harbor station, which furnishes 100 horse power, driving five primary dynamos at 450 volts. The distribution of the electric energy is accomplished by means of the triple conductor system at 2 × 250 volts. In the bins there are six electric motors of 15 horse power, for operating the elevators, one for the upper carrier belts and the exhauster, two in the cellar for operating the belts there, and one for the cleaning machine; ten in all. There are also two electric hoisting devices with two direct coupled 20 horse power motors. These raise one ton 1 ft. 7 in. per second.

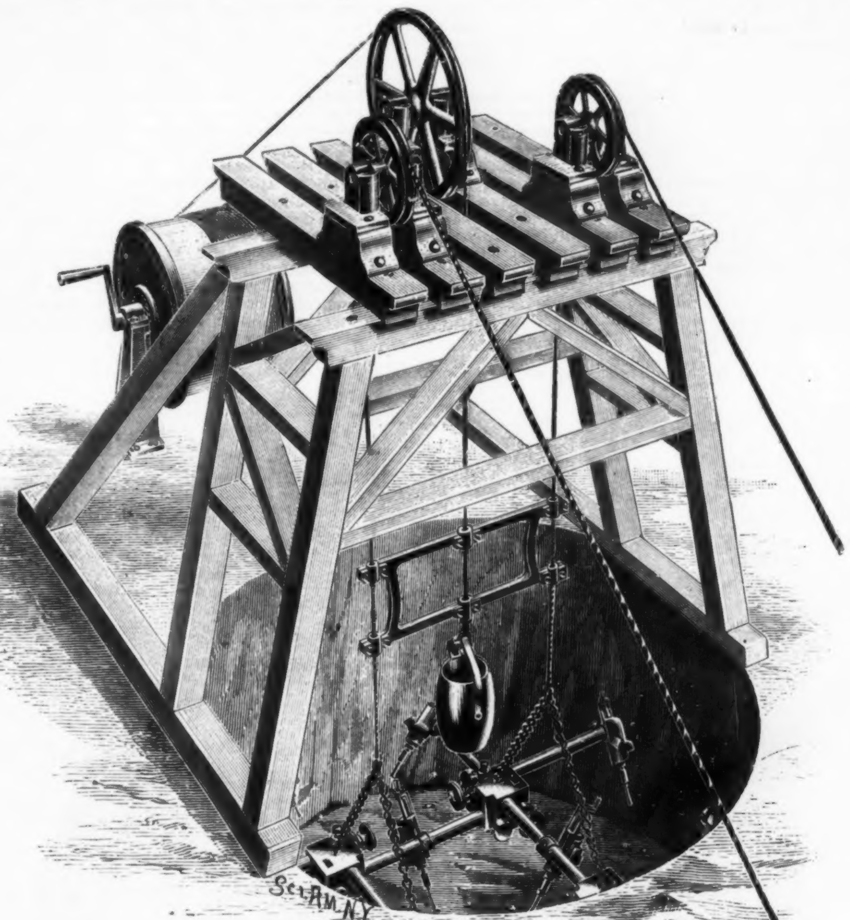
The electric driving devices, which are here used on a larger scale than ever before, have proved excellent. The fact that they are always ready for use and that they do away with the heavy transmission bands or ropes which are usually carried to the upper stories render this superior to all other methods.—Oesterreichische Monatsschrift für den Oeffentlichen Baudienst.

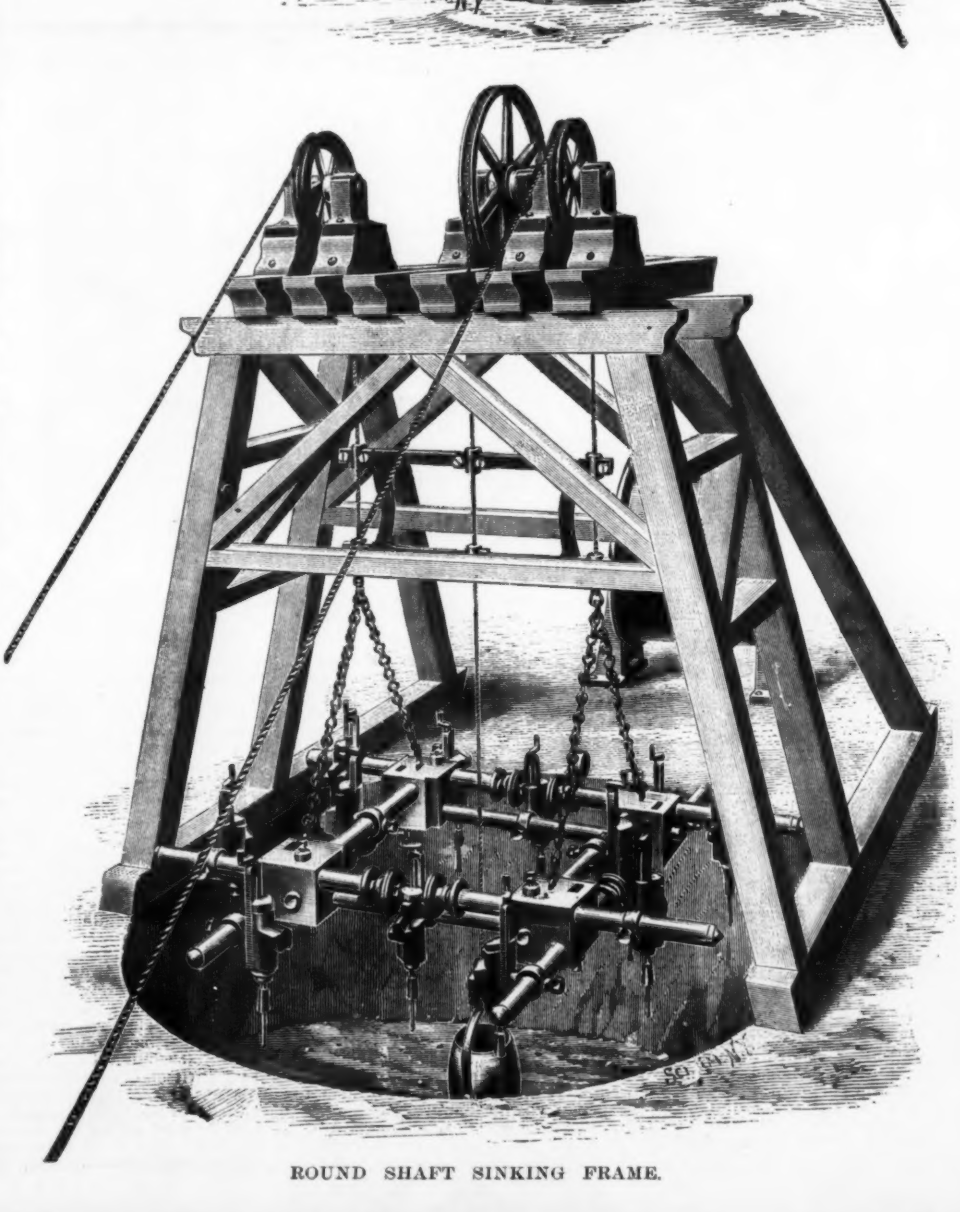
McCULLOCH'S FRAME FOR SINKING ROUND SHAFTS.

THE sinking of a round shaft, with present known appliances, is a far more difficult operation than the sinking of a rectangular shaft. In a rectangular shaft, varying from 7 ft. to 8 ft. in width, a bar of that length, fixed to the sides of the shaft, will retain its rigidity sufficiently when the drills are in operation; but in a round shaft, where a fixed bar has to be the whole span of the shaft's diameter, the length is too great to secure the rigidity of the bar when the drills are in operation; hence tripods and mounted bars have to be used, which are ineffective in their work, and entail a maximum amount of labor and cost, with a minimum result in the speed of sinking. McCulloch's shaft-sinking frame is so designed that the bars on which the drills are operated shall be perfectly rigid, removing at once all difficulties connected with the sinking of round shafts, and enabling them to be sunk with an economy in working and with a speed in sinking never yet attained.

Seeing, then, that drills working on mounted bars or tripods cannot give such effective duty as they would if fixed on perfectly rigid bars, it necessarily follows that to attain a maximum speed in sinking: (1) The drills, to give their full duty, should work on a perfectly rigid bar or bars, and that these bars should be arranged so as to get as large a number of drills as possible working in the shaft simultaneously. (2) That they should be placed and adjusted on the bars so as to pitch the blasting holes in the shaft in the most advantageous positions, in order that the maximum result may be obtained when blasting. (3) That after the boring of the floor of the shaft is completed, the whole of the frame and boring plant shall be removed expeditiously and easily out of reach of the blasting.

The inventor claims that he has secured all these essential advantages in this sinking frame. (1) The drills, when in the act of boring, will give out their full effective duty, as the bars on which they are fixed



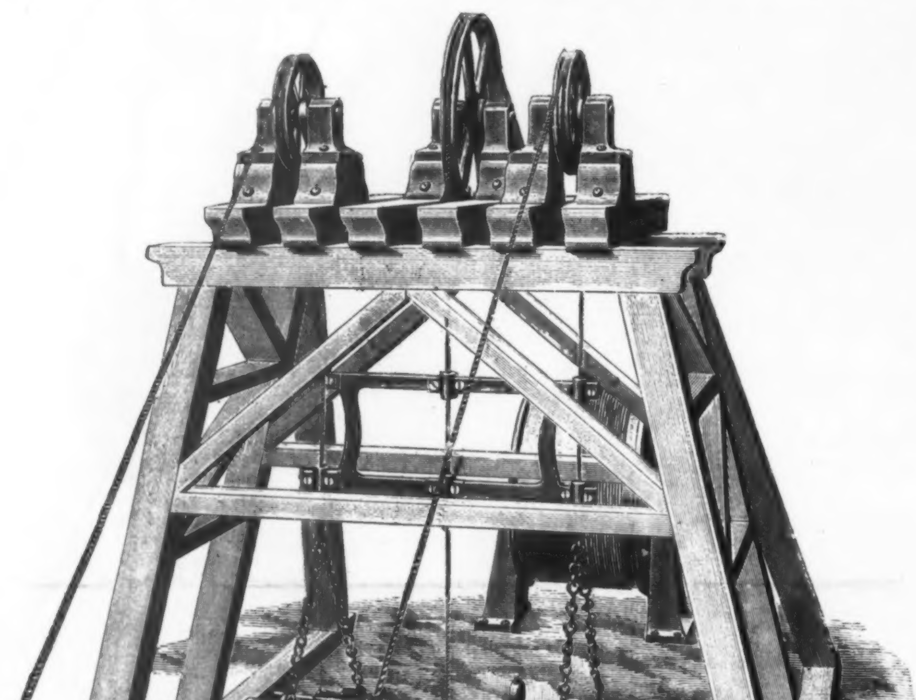


ROUND SHAFT SINKING FRAME.

remain perfectly rigid against the circumference of the shaft, and the frame is designed to carry twelve or any less number of drills, of which all or any number desired can be worked simultaneously. (2) The drills can be so placed and adjusted on the bars that they will command any part of the shaft, and with ease. (3) And lastly, the whole of the frame, with the drills still fixed on the bars and other tackle, can be hoisted in one operation out of the reach of the blasting, and it is so arranged that the hauling to surface of the broken rock passes through the center of the frame; it is, therefore, not necessary to hoist the frame to the surface, but only so far as will remove it out of reach of damage in blasting.

The inventor also claims other advantages in the use of this sinking frame. It will serve as a template or guide in the sinking of a shaft. It can be utilized as a scaffold for the bricking up of a shaft. It can be used as well for the examination or fixing of the pump or gear work of a shaft.

The frame is suspended from a poppet head with hoisting gear both for the frame and kibble. It is lowered by two ropes working from the poppet head of the shaft, and is attached to the crossheads of the frame, and these ropes pass through a guide. The kibble rope also passes through the same guide, thus preventing the kibble from swaying, and avoiding as well any possible entanglement with the frame ropes.



ROUND SHAFT SINKING FRAME.

The frame is built up of hollow steel tubes—twelve in all—on which twelve or any less number of clamps are placed. The center of the frame is a square of four fixed bars, held together by four strong crossheads. The movable bars—eight in number—pass through these crossheads, at right angles to the fixed bars or framing, and are moved quickly to the circumference of the shaft by a rack and pinion. The cone parts of each bar are then screwed up against the shaft by a screw operated at the back end of the bars, and which moves within the bars or tubes. The importance of this arrangement is very great. It enables the frame to be tightened up against the shaft when the drills are in actual operation, and not in any way altering their position, or the holes that are being bored. It is also automatic in its movement, for whenever the frame is loosened—through the jar and vibration of the drills, or from any other cause—the lever and weight attached to each screw of the bar has a tendency to tighten the frame against the shaft's circumference. The movable bars are all held tightly and firmly in position by set screws and pads. The frame has only to be lowered to the required distance from the floor of the shaft, tightened against the circumference, and it is at once ready for work.

This frame is shown by the Tuckingmill Foundry Company, at the exhibition of the Royal Cornwall Polytechnic Society, Falmouth and Cambourne. We are indebted to The London Engineer for the cuts and particulars.

CHINA AND HER RAILWAYS.

One of the greatest paradoxes ever presented to the world in connection with the material advancement of a nation is afforded by China. Boasting of a civilization of remote antiquity, claiming to have invented the mariner's compass, gunpowder, and the art of printing, and priding herself upon the initiation of numerous other attributes of modern civilization, she persistently lags behind in all things most essential to national progress. This is particularly noticeable as regards railways. With the motheaten mantle of a long past age descending upon the shoulders of her rulers, generation after generation, they still hold the doctrine that China is the hereditary fountain of all knowledge and advancement, and that any suggestions coming from the West must be, in the nature of things, either retrogressive or only prompted by sinister motives. When by force of circumstances, and owing to external influences, China has been persuaded into taking a step in advance, she has afterward repented of her wisdom, and has willfully demolished in a day the fabric that cost her years to rear. This was the attitude she assumed twenty years since with regard to the Shanghai-Woosung Railway, which was the first line ever constructed in China. It was regarded as a barbarian innovation, and no sooner had the ten miles of railway been built, equipped, started and begun to pay, than the whole line was dismantled and torn up, its stations and other buildings razed to the ground, and some of the constructive materials thrown into the river. It was opened in 1876 and wrecked in the following year. Curiously enough, the Chinese have a proverb that "true wisdom lies not in servile imitation of the past, but in availing one's self of such improvement as experience may have suggested." Pregnant words, full of wisdom to Chinamen in theory, but worse than a dead letter to them in practice.

The reason of this condition of things is not far to seek. It commences with the early education of Chinese officials, and finishes with their effete and corrupt administration when in office. Their utter impotency is a natural result of their education, and they are dominated by the mendacious traditions of their office, which traditions are their lawful and recognized heritage. Not only does their education not fit them for the practical work of government, but by its theoretical and purely academic character it absolutely unfits them for it. Not but what the Chinese educational system is a model of completeness, but it lacks practical backbone. In the mere matter of administration it would form a model for western nations, and yet in itself it constitutes the greatest obstacle to progress. Every youth in the empire is at liberty to compete for the honors awarded to scholarship, and by a process of sifting the candidates are reduced to a very few. The most successful of these, subject only to certain conditions of birth, are eventually installed in the highest government posts. Thus it may be said that the principle of competitive examination is carried to its logical issue, the community being governed by its most learned members. But, unfortunately, the educational system deals only with the lore of the past, modern thought is not only neglected, but regarded with reprobation and contempt. Western ideas, where they differ from those of Confucius, are only regarded as the eccentricities of barbarians. With rulers imbued with notions such as these, it is not to be wondered at that China has never evinced a genuine desire to identify herself with other nations in the cause of material progress.

So far we have indulged more or less in generalities. Let us now enter a little into detail respecting commercial enterprise in China in the past, and so justify our animadversions. For our present purpose three illustrations will suffice, namely, the introduction into China of cotton mills, the electric light and railways. Some twenty years ago a native company was formed for the purpose of establishing a cotton factory in Shanghai. Want of funds retarded the erection of the mills, and after about six years the matter was taken up by another company, partly native and partly foreign, but under the auspices of an American mercantile firm. Steps were quickly taken to have the representative of the American firm secretly arrested upon a trumped up charge and deported to Nankin. The conspiracy, however, was so transparent that the American consul refused to countersign the warrant, and so the matter fell through. The action of the officials, however it may have been prompted, in attempting thus to strangle a foreign innovation, is deserving of the severest reprobation. Nor were the proceedings as regards the introduction of the electric light less worthy of condemnation. A company commenced operations in Shanghai some twelve years since, and the natives readily introduced the new light into various theaters and public saloons within the radius of the concession. No sooner was the enterprise fairly started than the local authorities forbade the use of the electric light by all Chinese, and at the same time the foreign consuls were requested to order the municipal council to remove all the electric lamps in the public streets on account of their mysterious and dangerous nature. The consuls had little trouble in giving a suitable reply to the latter request, but the natives in the foreign settlement, who are, of course, civilly and criminally responsible to their own authorities, had no alternative but to submit.

The opposition to the introduction of railways into China, more especially trunk lines, has proceeded not so much from any aversion to the innovation on the part of the people as to the fact that the officials throughout the empire recognize the danger thereby threatened to the system of illegal taxation on which they thrive. This fact has not been sufficiently realized by the advocates of the introduction of this system of locomotion. Let us briefly trace the history of this advocacy and its results. It is now about forty years since steamboats were successfully introduced into Chinese waters. Some ten years later the late Sir R. Macdonald Stephenson, who had already done so much for the development of railways in India, visited China on a similar mission. The people enthusiastically welcomed him, and his advocacy apparently broke down the last flimsy thread of native prejudice. But Sir R. Macdonald had to reckon with other than the people before he could lay his foundations for the enterprise. The local rulers were up in arms, and raised a general opposition to railways, fearing, as we have pointed out, that they would interfere with their privileges in turning their local taxing powers to the best account. A contributor to this result was probably the very completeness of the scheme which Sir R. Macdonald placed before the authorities. Had he confined himself to a short trial line, he might have been successful in driving in the thin end of the wedge. But fresh from his Indian victories, his scheme embraced the bringing of Calcutta into railway communication with Peking. Hence his motives were either misunderstood or only regarded with suspicion, and so railways in China were not yet to be.

But the idea was not given up. Hope springs eternal in the English contractor's breast, and so it came to pass that, after a time, it occurred to those interested in the matter that the construction of a short line at one of the ports amenable to European influence might form the basis of some extended operations subsequently. Hence the Shanghai-Woosung Railway, the history of which enterprise is not without interest nor its fate without a lesson. In 1865 a company was formed for constructing a line on this route, by which means the changeable and difficult navigation of the river between those two points would be superseded. At the bottom of this scheme were Messrs. Jardine Matheson & Company, who were ever consistent supporters of the various efforts to introduce railways into China. They came to the conclusion that the only feasible plan was to acquire the land and construct the line themselves. The acquisition was a tedious, difficult and costly process, but it was eventually accomplished and a survey of the line was made by Prof. Henry Robinson, C.E., who was appointed engineer of the line. But Messrs. Matheson were not the only persons who had cast longing eyes on China as a field for railway operations. Independently of that firm, and in entire ignorance of their proceedings, the late Mr. Richard C. Rapier, of the firm of Ransomes & Rapier, of Ipswich, had given his attention to the problem, and he conceived that the best way of making a start toward its solution was to send a short length of line—rails, engines and carriages—to the Emperor of China as a present upon the occasion of his majority and marriage. He thought that if the Emperor once experienced the pleasures of a short railway trip, he would certainly desire an extension of his ride. In 1873 the idea began to take definite shape, the late Duke of Sutherland being the first to associate himself with the project. The King of the Belgians subsequently took an active interest in the scheme, and the writer was with Mr. Rapier in Brussels when the project was placed before his Majesty. The movement was at first well supported in diplomatic circles both in this country and in Belgium, but as this course of procedure was ultimately found to be impolitic, the idea was abandoned.

Mr. Rapier, however, still nursed his long-cherished idea, and did not despair of introducing the railway

system into China. He therefore built a small engine weighing only 22 cwt., and Mr. John Dixon, the well-known contractor, who interested himself in the matter, provided about half a mile of light rails and fastenings, ready to be sent to China with the engine, should opportunity arise. In the meantime, Messrs. Matheson's line was being made, and a coalition of all parties interested was brought about. The idea, then, was to send out the rails and engine, and, so far, equip the Matheson line. But its construction had not been completed, and, what was worse, the allotted funds were nearly exhausted. The railway company had only £20,000 left, which was insufficient to carry out the line. At this juncture Mr. Dixon threw himself into the breach, and liberally undertook to complete the line for £20,000—the balance of the company's capital—and £8,000 in shares. He faithfully carried out his contract; the line was made and equipped, and was opened amid public rejoicings on July 1, 1876. But at one o'clock on October 20, 1877, the last train was run from either end, the line being directly afterward ruthlessly dismantled, having been purchased by the Chinese authorities for that purpose. Portions of the rolling stock and plant were sent to Formosa, the remainder being thrown into the Yang-tse.

Such was the fate of the first railway in China. In recent years, however, owing to native influence, the effort to introduce this system of transport into the country has proved more successful. Witness the Shanhaikwan-Tien-Tsin line with its extension to Peking; and if all goes well, far greater extensions will be witnessed, and railways will yet encircle the Celestial Empire. The Chinese are not wholly a nation of imbeciles. There are men of thought, of astuteness and of business ability among them. Of such is Shêng Ta-jên, whose antecedents, however, judged by European standards, are probably less immaculate than those of most Chinese mandarins. No matter, he has satisfied the Emperor of his intelligence, and climbed into power on the shoulders of Li Hung Chang. He was appointed director-general of railways about a year ago, and he quickly succeeded in obtaining an imperial edict for incorporating the Shanhaikwan Railway, with his proposed great trunk line from Peking to Hankow, which will be about 900 miles in length, and which presents some engineering difficulties. This is a big order even for Shêng Ta-jên, who controls the Chinese telegraph system and the great iron works at Han-Yang, besides which he is a director of the China Merchants' Company and the founder of the new Imperial Bank of China. At the same time it was reported some three months since that a Belgian syndicate had successfully negotiated a contract with the Chinese government for the construction of the Hankow line.

In the meantime Shêng wisely purposes commencing with schemes of lesser magnitude, such as lines connecting Woosung, Shanghai, Hangchau, Soochau and Chingkiang. This route lies through a wealthy and populous district, and presents no constructive difficulties, the total length being about 200 miles. The Shanghai-Woosung line was the first to be tackled, and is in course of construction. It practically follows the route of its ill-fated predecessor, and is to be laid on the English 4 ft. 8½ in. gage, which gage has been adopted for all the imperial Chinese lines. It is a purely native undertaking, and the rails are to be supplied by the government iron and steel works at Han-Yang, while the carriages are being built at the government works at Tien-Tsin. The sleepers are to be supplied from America, Messrs. S. C. Farnham & Company having secured the contract. The locomotives will be built in the same country by the American Trading Company, the present contract being for three tank engines. The iron bridges have been ordered from Germany and the switches from Belgium. England, the pioneer of railways in China, supplies nothing. Such is the irony of fate. There is, however, a chance yet, provided our labor troubles cease and trade gets reorganized in time. A fair start having thus been made under favorable auspices, it is not inconceivable that a very considerable railway system will eventually be developed in China.—Perry F. Nursey in Industries and Iron.

ANCIENT CLOCK BELLS.

IN the representations of the clocks of the end of the fifteenth and of the whole of the sixteenth century we find peculiar arrangements of external bells. We shall explain these, because they are now unknown, the original clocks having disappeared or become disfigured.

In the clocks of those times the hammers were very large and were mounted upon long levers provided with a tail or prolongation from which frequently depended a wire. It would seem as if this pulling arrangement were a reminiscence of belfry clocks, in which the watchman had to supply the blows that the wheelwork frequently failed to strike; but the case is not the same, and we cannot very well conceive of the owner of a clock striking the incomplete hour himself. In the various representations of the clocks which we have studied we shall find an explanation of these functions.

The owner of a clock, having a bell within reach of his hand, must necessarily have conceived the idea of using it to call up his servants. All that was to be done was to find a hammer arrangement and the proper length of wire. It was, upon the whole, an intimate application of the striking work of belfry clocks, the tolling of the bell of which served formerly, as it does still, to give alarms. We find an example of this call bell in an engraving in a book by Crispin de Passe, entitled Parabole des Vierges, in the National Library of Paris (Fig. 5). This engraving represents a clock upon the top of which there is placed, crosswise, a hammer that is entirely independent of the clock and that must have served for striking the bell. The two functions of call bell and time bell united in the same clock are very clearly shown in an engraving of the sixteenth century found in the Livre des Bons Engins preserved in the National Library (Fig. 4). In fact, we here see, on one side, the isolated hammer with its lever, and, on the other, the hammer that is directly actuated by the wheelwork of the striking train. There is, therefore, no doubt as to what each of them was designed for.

An engraving by Jean Cousin, entitled Fortune, Amour, Temps (Fig. 1), shows us, in a clock held by a female symbolizing Fortune, a bell surmounted by a single hammer with a lever from the extremity of which hangs a wire. This clock has the weights and counterpoises of the movement and striking train, and this conclusively shows that it must have struck the hours in running concurrently with the call bell, or in silence. At the extremity of the wire, in fact, there is a ring which it sufficed to connect with a detent placed in the interior of the movement (as in the clock shown in Fig. 3) in order to have the clock strike the hours, while, when the wire was detached, the clock became silent.

The object, therefore, was to obtain silence when it was deemed advisable; and to effect this was worth while, since, as we have already remarked, these striking arrangements were very powerful, both by the size of the bell and that of the hammer. It must, therefore, have been the desire of the owner of such clocks not to be compelled, under any circumstances, to listen to their often exaggerated noise. There are, moreover, in our own day, clocks that run in silence.

As soon as the striking train of clocks was devised, there was very naturally an effort made to render it interesting, and so its motive power was soon utilized for actuating chimes concurrently with the simple time bell. Therefore, by the side of the ringer of chimes, who from all times had played with more or less talent, the clock repeated the airs of its cylinder automatically. The chimes of belfry clocks and those of house clocks date from the middle ages. The clocks of these remote epochs have nearly all disappeared. The wheelwork, worn out by long service, has been suppressed or replaced, and the simple airs of olden times have been changed. One of these airs, dating from the fifteenth century, and which has come down to us, is that of Vendome, which comprised words that were modified according to the locality. The most celebrated chimes were those of Flanders.

There were belfry clock chimes that possessed a decorative character, in the sense that they were sounded by "jacks of the clock" that struck the bells in turn. Such was the clock of Liege. Others were distinguished by the splendor of their wheelwork (Fig. 2); but, in reality, the chimes derived their effects exclusively from the variety and purity of tone of their bells.

Although house clocks also had chimes as long ago as the fifteenth century, it was especially in the sixteenth that they came more and more into use. The bells were so placed in the campaniles as to be visible, or else were concealed in the interior of the frame.

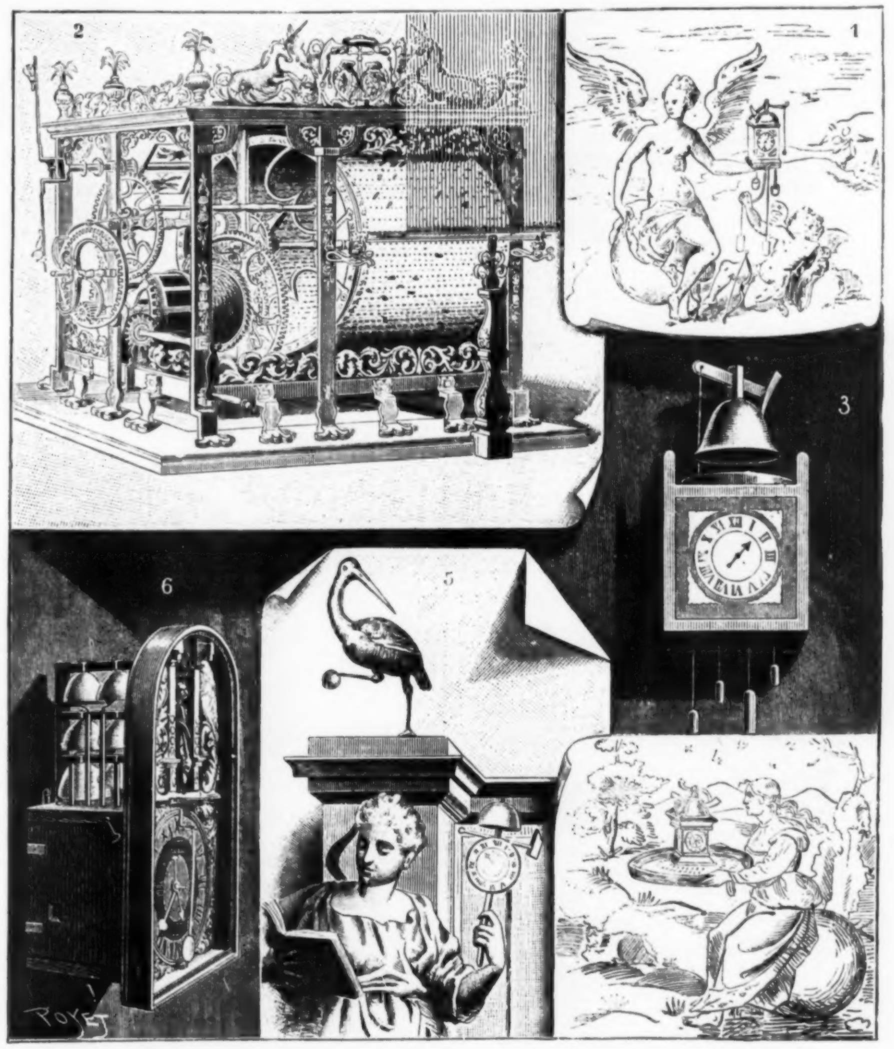
In our collection there is a wooden clock of the end of the sixteenth century which, for its chimes, has six perfectly tuned glass bells, which are fixed in a wooden frame at the top (Fig. 6).

The Louis XIV and Louis XV clocks, which were suspended from the wall, had chimes which were placed either in the case or in the support. In the time of Louis XVI mantel clocks also were provided with them.

In addition to chimes, there were other musical arrangements. Everyone is acquainted with the music produced by the steel comb, which has not changed since the eighteenth century, and everyone has seen music boxes. But dulcimers are not so well known. These are string instruments, like pianos, and the keys of which are actuated by cylinders provided with pins. They have scarcely been applied except in large centerpieces for rooms. The organ stops of clocks and the harmoniflutes have the same system of bellows and pipes as the large church organs and recall the primitive portable organs of the middle ages.

In finishing this brief notice of the curious arrangements introduced into the striking works of clocks, we must not forget the ancient cock and the eternal cuckoo, which, after flapping their wings and opening their bills, sing as many times as there are hours to be indicated. They made their appearance in the middle ages and have been manufactured ever since.

There is still another time-announcing device to be mentioned, and, although it marks the last step in the progress made in this direction, it is not the best. We refer to the phonograph. As for us, we prefer the merry chimes of the days of yore to the voice that announces the hour after the manner of the undertaker's assistant when he calls out that the funeral procession is waiting.—La Nature.



ANCIENT CLOCK BELLS.

1. Engraving by Jean Cousin. 2. Wheelwork of chimes. 3. Clock with call bell. 4. Reproduction of an engraving from the Livre des Bons Engins. 5. Reproduction of an engraving from the Parabole des Vierges. 6. Clock of the sixteenth century.

ELECTRIC RAILWAY DEVELOPMENT AT HOME AND ABROAD.

ENGLISH contractors (Dick, Kerr & Company, of London) have secured the order for the electrical equipment of the street railway systems of Madrid and Barcelona, Spain, but the subcontract for the generators and full station equipment has been placed with the General Electric Company, of Schenectady. The Railway World, of London, states that 160 motor equipments will be required for these lines and that the full amount of the original contract is about $800,000. The following extract from a press dispatch from Schenectady, dated September 26, is an interesting comment on the use of American electrical machinery:

"While Lord Kelvin was in the act of gratifying his intense curiosity about the General Electric works here, news came of the closing in New York of further contracts, employing English capital, for large electric railway systems in Dublin, Madrid and Barcelona. The amount involved is said to reach £500,000. Lord Kelvin was asked his views on this matter. He said: 'I do not consider it out of the way or surprising that these orders should be placed here. England has not yet developed her electric railway work to as large an extent as you have, and hence is buying, as she always does, in the best market to save money. She has the engineering and manufacturing talent, but lacks the opportunity. Here you have towns of 10,000 population springing up in a year, and they naturally want the latest and best, making a good demand, which renders easy production on a large scale and also stimulates the older communities near them. We have no

such developments in England, and the areas of our towns are smaller, so that the necessity of city transportation is not so keenly felt as with you.' "

The same state of affairs was recently considered by The Electrical Engineer, of London, and the remarks of that journal are interesting as showing the British point of view: "We have been pleased to note that the English contracts for electric tramways are being placed more frequently with English contractors, and that in certain cases the English contractors have obtained important contracts abroad in the face of the direct opposition of agents from America. This condition of affairs is gratifying to the profession, but the fact that the majority of the material used, even by English contractors, is obtained from America is to be deprecated. The reason for this is to a certain extent to be found in the fact that the severe competition in America has reduced the prices; but, on the other hand, it is also the fact that in some departments the English manufacturers are not sufficiently prompt to take up the requirements of the new industry. We were informed, for instance, the other day, by a large contracting firm that the steel poles for the construction of an important electric tramway they were equipping had been ordered from an English firm at prices which compared favorably with those of American goods. The order having been placed, considerable trouble arose from the delay in delivery, and the organization of the line was seriously impeded from this cause. Delays of this kind naturally tend to keep the trade out of the country. Another point we have noticed recently, when inspecting new traction plant, is that the American engine builders have paid particular attention to the design of their engines for traction work; whereas the tendency of the English manufacturers is to supply an engine which has been found suitable for electric lighting purposes. It by no means follows that this engine will be suitable for traction work, because the rapid way in which the load varies and the short duration of the periods of extremely heavy loads strain both the engine and its governing arrangements most severely. If our manufacturers will keep themselves to the fore in matters of detail of this kind, we see no reason why the present procedure of ordering goods from abroad should continue. The boom in electric traction which is now commencing will then benefit the English profession and enable the manufacturers to hold their own in colonial tramway equipment. Not only in English speaking countries, but on the Continent electric tramway schemes are being decided upon every day, more particularly, perhaps, in the mountainous regions and other places where there is a plentiful supply of water."

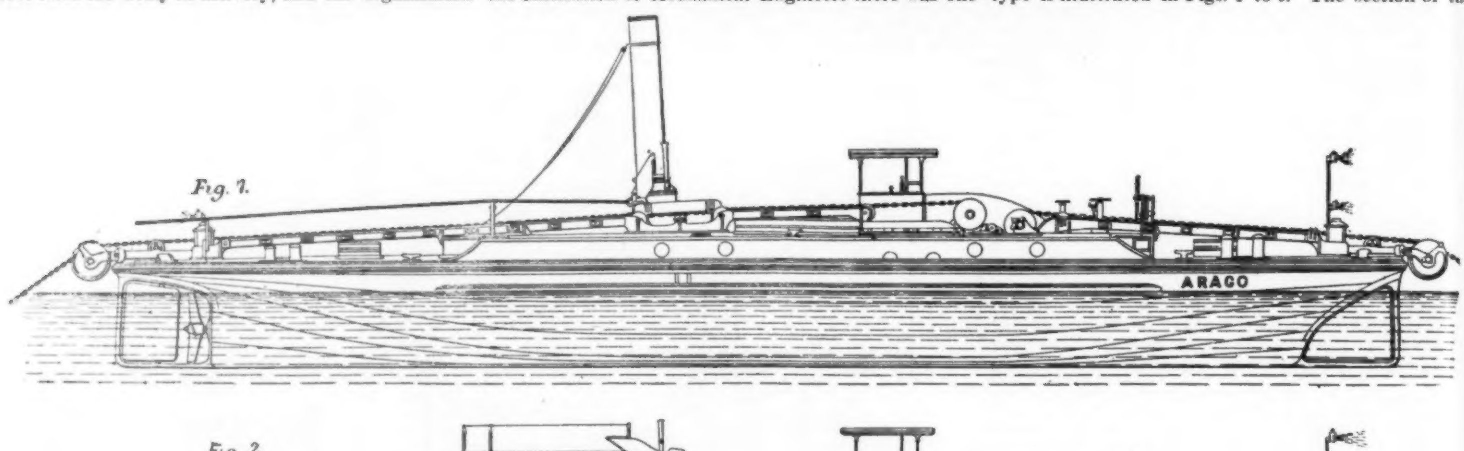
In Australia the American cars are very favorably received, to judge from the following note in Transport: "The railway commissioners of New South Wales are experimenting on the Sydney tram lines with an open car of American make and design. The new car is the theme of local admiration and of eulogistic notices in the press. The old car, which is its companion on the road, is practically deserted. Everybody, in fact, rushes to this elegant and attractive vehicle, which not long ago was publicly tried for the first time. It is said that as a summer car it would be difficult to surpass it. It is perfectly open from end to end, the sun, wind or rain being excluded by cleverly designed blinds, which can be lowered or raised at will, and which, being on the automatic principle, stop just exactly in the position wished. The seats are reversible, being made of light wood, beautifully polished. It runs particularly smoothly, and has accommodation for 40 passengers, with a small cab at each end for the man controlling it. This, of course, is when the car is driven by electricity. The real name is 'The Brill Car,' being manufactured by the firm of that name in Philadelphia. The truck on which it runs is called the 'Peckham' truck. The car being about half the weight of those at present in use, will effect a large saving in haulage."—Western Electrician.

ELECTRIC TOWAGE ON CANALS.

AMONG the papers read before the spring meeting of the Institution of Mechanical Engineers there was one on "Mechanical Propulsion on Canals," by Mr. L. Robinson. The subject was quite extensively treated in this paper. It was stated that the efficiency of side wheels or a screw applied to towing is half that due to chain haulage. In dead water a chain haulage boat with a force of 100 horse power is equivalent to a tug of 200 horse power; and against a current 100 horse power in the former is equal to 400 in the latter, if the speed of the convoy is equal to that of the current; while if the difference increases rapidly, the speed of the two falls below that of the current. It is evident that the many advantages of the chain (except that of draught) in going up streams disappear in coming down. The heavy chain cannot be allowed to pass over the gear in the boat at too high a speed, and thus it is not desirable to give the convoy as great a rate as that of the current; but, on the other hand, if this speed is approximately maintained, the transit becomes dangerous, and if it falls below, it becomes impossible. From the foregoing considerations it appears that the most efficient system would include a boat adapted for chain haulage going up stream and as a tow in coming down.

The mechanical arrangements that have been devised to maintain the movement of the towing chain have been unsatisfactory and complicated. M. Bovet, a French engineer, has sought to grip the chain by the action of an electromagnet. The magnetized pulley is practically a solenoid with a soft steel core, the two ends of which are extended and brought close together in order to form the two flanges of the pulley. The pulley also possesses features of interest. The adhesion is sufficient to prevent slipping under any conditions that may occur. The first trials of this class of pulley were made with chain towboats built for service on the Seine, below Paris. Only one pulley was employed in the preliminary experiments. Our engraving illustrates an electric towboat for canals constructed for the Compagnie des Touages de la Basse Seine et de la Loire.

The first boat of this type with magnetic adhesion gear was tried and put on service by the towage company of the Basse Seine, in 1893. It was fully described about that time at the Fifth International Congress of Internal Navigation. (See the published proceedings of that congress; the Memoirs of the Société des Ingenieurs Civils, 1893; and the Revue Universelle, May, 1893.) Three other boats of a similar type have, more recently, been put in service by the same company, and on these several modifications suggested by experience have been introduced. As regards the towing machinery, the changes have been very small, but alterations have been made in the construction and arrangement of the boats themselves, so that they differ considerably from the earliest model. The most recent type is illustrated in Figs. 1 to 6. The section of the

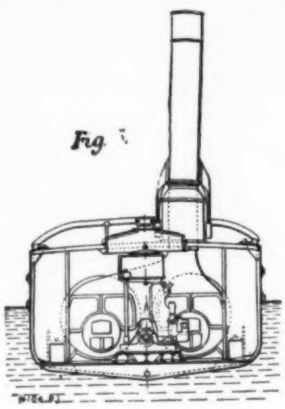


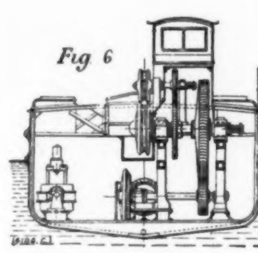
ELECTRIC TOWBOAT FOR CANALS—BOVET SYSTEM.

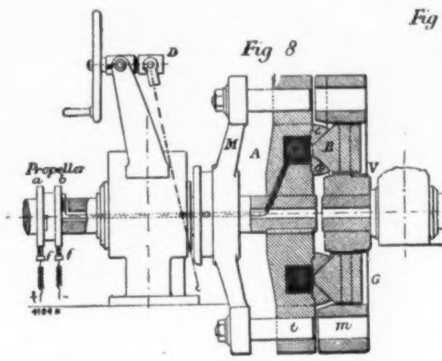
Seine on which these boats are running is of considerable depth, and advantage has been taken of this fact to supplement the chain haulage with a screw propeller, and the form of the hull has been modified to suit this auxiliary propulsion. As on all boats of this class where steerage is difficult on account of the action of the chain, two rudders are fitted, one forward and the other aft. The total length measured on the deck is 31 meters (101 ft. 8 in.), and the outside width is 5·470 meters (17 ft. 11 in.); the normal draught of water is 2 meters. The hull is divided into five watertight compartments by four bulkheads; forward there is a hold, and the accommodation for the deck hands, while aft there is a similar hold, and the living room of the machine hands. The engines are placed amidships, and the deck over them is raised 18 in. The construction of the hull and deck is very solid, as will be seen by reference to Fig. 7, where 1 and 2 are the forward and aft bulkheads, and 3, 4 and 5 are heavy double T transverse beams; 6 is a lattice stiffening girder. The girders a, b, with the transverse beams 2 and 3, inclose a hatchway, through which the boilers can be removed if necessary; c and d connect the transverse beams, 3 and 4, and serve as a means of attachment of the chain brake and of the tow hook. The girders, e and f, with the transverse girders, 4 and 5, frame the engine hatchway. The chain well is shown at g and h. The brake, k, and the main frames, l and m, connect the lattice gird-

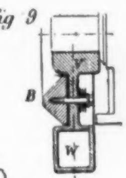
er, 6, to the forward bulkhead. The tow gear, that is the two cables by which the convoy is attached to the tug, is fastened to the lattice girder, 6. It is this girder, therefore, which has to resist the chief pull of the chain and the resistance of the tow. In the engine room there are two internally fired boilers with return flues, registered for a working pressure of 8 kilos. (114 lb. per square in.), and each with 50 square meters (538 square feet) of heating surface. A vertical compound engine drives gearing so arranged that it can transmit power to the screw or the chain apparatus. The system of transmission is shown in Figs. 2 and 3. That for the chain is from the main shaft to the driving pulley of the chain, by two toothed wheels keyed to the with the full tow. To facilitate this a shifting gear worked by hand is employed, by which high pressure steam is admitted direct into the large cylinder. It would be preferable on boats of this class to have an independent motor for the screw, and one for the chain, and the arrangement we have described was adopted only on grounds of economy; as a matter of fact, however, the single engine has satisfied all requirements. The chief defect is, that having available a much higher power than is necessary for chain haulage, the crew are tempted to run too fast, and so incur a serious danger of breaking the chain. But it is possible to check this by attaching a speed recorder on one of the chain shafts.

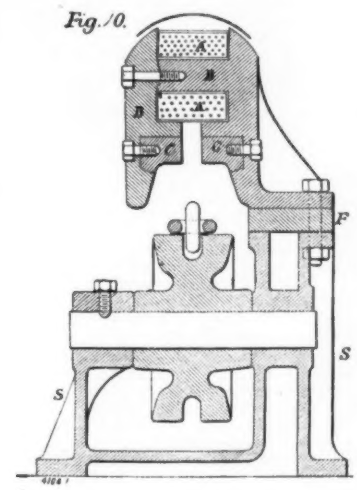
attached to the forward bulkhead; the conductors are laid within wood casings, and the resistances are placed on the right of the chain well. (c) An ejector used for filling and emptying the aft compartment of water ballast; for removing water from the hull and from the chain and pulley well; for washing the deck and chain run, etc. There is a combination of valves by which these various services can be effected with the steam pump of the main engine. Reference was made above to the water ballast in the aft compartment. When running on the chain this compartment is empty, and the boat is practically on an even keel. When running with the screw the compartment is filled so as to bring the stern down sufficiently for the screw,

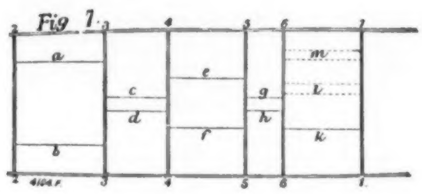


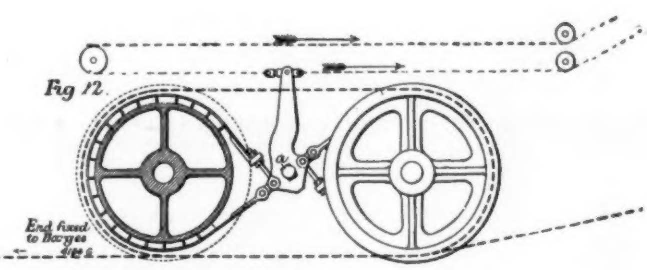


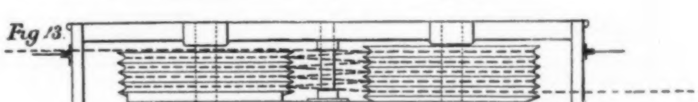












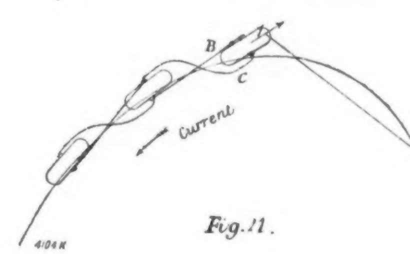


FIG. 14.

ELECTRIC TOWBOAT FOR CANALS—BOVET SYSTEM.

two shafts. As a general principle the boat is only driven by the screw in coming down stream, and the power required for this is higher than for the chain towage; the transmitted speed is therefore greater for the former than the latter. The engine is designed for working at different speeds; the normal being 150 revolutions when driving the screw, and from 70 to 90 when working the chain gear. When developing 150 horse power at 150 revolutions the consumption of fuel is 2·2 lb. per horse power. Detachment from the chain might be a difficult operation, if from any cause it became necessary to stop in midstream, and then start

There are also placed in the engine room the following apparatus: (a) A dynamo and motor for furnishing the current to the various magnetized devices. The engine has two cylinders, and may be worked single or compound; it can exhaust into the condenser of the main engine or into the air, as may be most convenient. This installation furnishes from 30 to 40 amperes, with a consumption of 18 kilogrammes of steam per electrical horse power, when exhausting into the condenser. The maximum power when exhausting into the air is 60 amperes, but with a considerably higher consumption of steam. (b) A distribution board

which is 1·70 meters in diameter. The compartments on each side of the main engine have together a capacity of 11 cubic meters (388 cubic feet).

With the arrangements that we have described, when the boat is driven by the screw, the chain mechanism is thrown out of gear, the screw shaft clutch is coupled and the dynamo is stopped. When working with the chain the screw is uncoupled, though it is desirable to be able to couple it again rapidly and without stopping the main engine, either to keep the boat straight if the chain break or to run it together with the chain. It is true that at the slow engine speed necessary for the

chain haulage, the screw cannot do much to propel the boat, but the wash from the propeller is thrown against the rudder, and helps the steering in turning round sharp bends. In order to facilitate coupling up quickly, a magnetic clutch is added to the mechanical coupling.

The development of this magnetic clutch, of which a large number are now in use, was due to the experiments with the chain pulley already described. It has the advantage of great adaptability, and can be readily thrown on when running, without checking speed or setting up any shock. Such clutches are in service on engines up to 800 horse power, and working at 100 revolutions. Figs. 8, 9 and 10 give a good idea of their construction. In these figures V is the flywheel of the engine; A, M, D are the parts of the ordinary mechanical clutch; excepting that the piece, A, instead of consisting of two arms, is formed of a circular plate with two projections, in which holes are made for guiding the tenons, d. In this disk, A, is cut a circular groove that holds a wire coil, the two ends of which, passing through the center of the main shaft, are led beyond the shaft bearings to two terminals, a, b. On this same disk are fixed the two jaws, c and d, the whole, A, c, d forming an electromagnet that can be excited by the coil. The armature of this electromagnet is a circular crown of wedge section, B, placed against the flywheel, V, of the engine; it is held in place by four sets of Belleville springs, arranged as shown in Fig. 9, and is capable of attraction to the surface of the electromagnet and of being held there when the latter is excited. This piece, B, is driven by the flywheel through two projections that slide in grooves cut in the flywheel. When the electromagnet is excited the armature becomes fast in the magnet, and the coupling is complete without the action of the mechanical clutch.

The chain traverses the deck longitudinally in the usual manner. Forward and aft are two switches, adapted to suit the oblique movement of the chain, and leading it to fixed vertical rollers, between which its position becomes fixed. Between these pulleys and the towing gear, the chain passes over a series of rollers placed in a watertight trough that collects the drippings and detritus brought up from the bottom. The main tow pulley is almost hidden beneath the deck. One side of the casing containing it is placed far enough away to insure complete magnetic insulation; the casing itself is of wood, lined with zinc. The small taking-off pulley, which has but little work to do, is mounted on the end of its shaft, and has one face thoroughly insulated. The leading-in pulley has, on the other hand, to resist a considerable strain; on account of the change in direction it gives to the stretched chain, it is mounted on a shaft carried in strong bearings on each side. It is an ordinary cast iron pulley, but it can be magnetized, and can be converted into a driving pulley by means of a toothed wheel on its shaft, gearing into another toothed wheel on the main shaft of the towing gear, which transmits movement to the taking-off pulley. The toothed wheel on the leading-in pulley shaft can be shifted so that the pulley can be either idle or driving; it is magnetized only in the latter case. The object of the arrangement, which is not really necessary, is to obtain greater adhesion if required. Directly aft of the towing gear is the chain well, which is introduced to keep on board a certain amount of slack. To the well is added a chain brake that regulates the rate of discharge, and the quantity kept in the well. It consists of a straight electromagnet, placed above the chain run. Fig. 10 shows it in transverse section. It is placed very close to the passing chain, and when magnetized attracts the latter; the rate of travel then depends on the degree of magnetization, and the weight of the chain aft of the brake. On the frame of this brake is mounted the hook used for attaching a tow when the boat is running with the screw. An examination of the drawings will show that when it is desired to take the boat off the chain the latter need not be divided, but the whole of the towing gear can be shifted to one side of the boat. For this operation it is only necessary, by means of the brake, to accumulate three or four meters of slack in the chain well, and to put stoppers on the chain at the switches fore and aft. Of course the boat has to be stopped, but the whole operation does not take more than ten minutes.

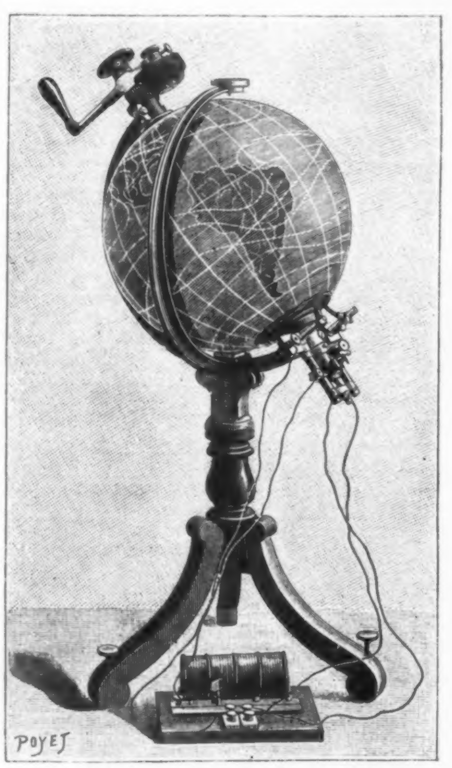
The captain has under his hand the steering wheel of the after rudder and the commutator lever, with which he can turn on and regulate the current for the various magnetic devices. The main and taking-off pulleys receive five, twenty-five or thirty-five amperes; the brake can receive three, six, nine or twelve amperes; the magnetic clutch of the screw is thrown in by pressing a button, without any variation in the current. The forward rudder is in charge of one of the crew, who also controls the various towing devices, about which a word should be said. The convoy is always attached by two crossed cables, and these require some manipulation, to insure its taking a proper course. Fig. 11 is a diagram showing a tow passing round a bend; the sketch shows the operation, the cable, B, being tightened and C slacked; if the bend were in the other direction, the maneuver would, of course, be reversed. Usually very large and heavy hemp cables are employed (they weigh five and one-half kilogrammes per meter on the boats of the Compagnie des Touages de la Basse Seine et de Loire), and there is a good reason for this practice. It is impossible to start a convoy without throwing a sudden and great strain on the cables, and as the barges are usually of light construction, they would be speedily damaged. But the heavy cables absorb the effect of this shock to a remarkable degree, and thus provide a simple but very effective method of protecting them. On the boats we are describing, an interesting experiment has been made by the use of light steel cables, combined with an elastic device, to absorb the shock. This arrangement is shown in Figs. 12 and 13; it consists of a double grooved drum, similar to the old chain haulage pulleys. The cable takes four half turns on each drum, and the end is rolled around a supplementary store drum. The two drums are held up by means of a brake, the arrangement of which constitutes the novelty of the system. As will be seen in Fig. 12, the brake consists of a band, lined with blocks of wood, and having its ends jointed to the head of a crank free to move around a vertical axis, a, and having a small amount of play in the direction of the tangent common to both pulleys. In this way the compensating action is automatic; the pressure is progressive as the boats forming the convoy are added, and as they move forward the required elasticity is obtained. When traveling the brakes are locked hard, and if it is desired to slacken one of the cables, it is sufficient to release the brake; the storage cable supplies the additional cable required, a light brake checking the tendency to unwind more than is required. On the towboat the bollards and storage drums are fixed under the deck, as is shown in the drawings, in such a way that all the necessary operations are controlled by four handwheels placed near the wheel of the forward rudder. Fig. 14 is a general view of the boat we have described, and shows the forward leading-in pulley, the towing apparatus and the leading-out trough.

THE MAGNETARIUM.

M. WILDE recently presented to the French Academy of Sciences an apparatus which he calls a magnetarium, and which is designed to reproduce the phenomena of terrestrial magnetism and the secular changes of the horizontal and vertical components.

The apparatus consists of two terrestrial globes, one of which revolves within the other. An insulated copper wire is wound around the inner globe, the axis of which makes an angle of 23·5° with that of the outer one, so that its equator revolves in the plane of the ecliptic. The interior surface of the globe is likewise provided with a winding of insulated wire, and the surface of the seas is covered with thin sheet iron, in order to cause a difference between the magnetism of the terrestrial and maritime regions.

The axes are provided with insulated rings, which revolve along with them. Copper brushes in contact with these rings cause electric currents to pass around the surface of the globes. By means of a train



THE MAGNETARIUM.

of epicycloidal toothed wheels, a slow differential motion is communicated to the internal globe, thanks to which there may be accurately reproduced the principal phenomena of terrestrial magnetism and the secular variations of the declination and inclination that have taken place for the last three centuries at London, the Cape of Good Hope, Saint Helena and Ascension Island.

The period of time that corresponds to a difference of one revolution in the rotations of the two spheres is 960 years, and the annual retardation of the electrodynamic sphere is 22·5′. This period comprises all the different secular variations of the magnetic elements upon the different parts of the terrestrial surface.

The apparatus likewise reproduces the various elements that follow: (1) The inequality of the periods of declination upon the same meridians in the northern and southern hemispheres as observed during the short period of western elongation at London (160 years) and during the long period of western elongation at the Cape of Good Hope (272 years) and at Saint Helena (256 years); (2) the simple displacement, in one direction or the other, of the dipping needle for the double movement, forward and backward, and of the declining needle, as it has been observed since the year 1723 in the continuous diminution of the dip for the British Islands during the motion of the declining needle toward the west and its return; (3) the changes of dip in an opposite direction upon the same meridian in the northern and southern hemispheres, as observed during the present period in the dip that diminishes in the British Islands and increases at the Cape of Good Hope, Saint Helena and on Ascension Island: and (4) the rapid increase in the dip in the vicinity of the Atlantic node of the magnetic equator (17 minutes per annum), as observed in the first place by Sabine in the Gulf of Guinea and at Saint Helena, as well as the western progression of this node itself.—La Nature.

TRADE MARKS IN THEIR INTERNATIONAL RELATIONS.*

IN early times manufacturers and merchants took the accumulations of months of labor to fairs, where such were disposed of in a few days—repeating the operation from year to year; but the modern methods of rapid intercommunication have made it possible for them to dispose of their products and purchases as rapidly as manufactured, or collected; hence the disappearance of the ancient fair, and the birth of the international exposition, where goods are exhibited not so much for the purpose of sale as for introduction.

The first international exposition was held in London in 1851, and was followed by an international exhibition in Dublin, 1853; an exhibition of industries of all nations in New York, 1853; a universal exposition at Paris, 1855; an international exhibition at London, 1862; the Paris universal exposition, 1867; and the Vienna exposition of 1873.

What was more natural than that manufacturers and merchants who had, at great expense, exhibited at these expositions should observe and discuss the perils which they ran by reason of want of protection to their marks? It was apparent that without such protection their display was for the benefit of the imitative in the country where the exposition was held. They also observed that goods bearing the same marks were sometimes exhibited by different parties from widely separated countries, and that the authorities were called upon by one to suppress the exhibit of the other.

The necessity for the international protection of marks wherever international trade existed was evident; but not until the exposition at Vienna in 1873 was the matter formally discussed at an industrial congress.

The discussion so commenced was continued at the congress concerning industrial property held at the Paris International Exposition of 1878. By resolution of that congress a committee was appointed to obtain the consent of the French government, or, failing in that, some other government, to take the initiative in calling an official conference of the commercial nations of the world to formulate a convention for the protection of industrial property. The French government happily took the initiative and a conference was held at Paris, commencing November 4, 1880, which drafted the convention for the protection of industrial property, afterward ratified at Paris March 20, 1883, with very slight changes only. This convention covers patents as well as trade marks.

At the conference of 1880 the following states were represented, viz., Argentine Republic, Austria-Hungary, Belgium, Brazil, France, Great Britain, Guatemala, Italy, Luxemburg, the Netherlands, Norway, Portugal, Russia, Sweden, Switzerland, Turkey, United States, Uruguay and Venezuela.

The Hon. William M. Evarts, Secretary of State, in his instructions to Mr. Noyes, minister to France, and to Mr. Putnam, minister to Belgium, as delegates, said:

"The subjects proposed for discussion are in a marked degree important to all countries whose trade and manufacturing industries have attained high development, and this country cannot but feel the liveliest interest in any conclusions which may advance and benefit its commerce and manufactures."

Mr. Putnam, at the conference, referred to the peculiar position of the United States, arising from the fact that power to legislate concerning trade marks was not specifically mentioned in the Constitution of the United States. The trade mark cases declaring the trade mark statutes of 1870 and 1876 unconstitutional had lately been decided in the Supreme Court and were fresh in the public mind. The conference favored the United States by inserting a special clause in the proposed convention to meet its case. This clause was somewhat modified in the convention as ratified. Our delegates took no part in the discussion concerning patents.

The convention was ratified on March 20, 1883, by the following only of the nations represented at the conference, viz., Belgium, Brazil, France, Guatemala, Italy, Netherlands, Portugal, Salvador, Servia, Spain and Switzerland. Salvador has withdrawn.

Since the ratification it has been adhered to by the Dominican Republic, Great Britain, Sweden and Norway, the United States, Tunis, Denmark and Austria-Hungary, with a proviso of legislative ratification.

The salient features of the convention (so far as relates to trade marks and trade names) are:

(Art. 2.) That citizens of each of the contracting states shall enjoy in all of the other states of the union the advantages, so far as concerns trade marks or trade names, that the respective laws thereof accord to citizens; they shall have the same protection as the latter, and the same legal recourse against the infringement of their rights, subject to the formalities and conditions imposed upon citizens by the domestic legalization of each state.

(Art. 6.) That a trade mark regularly registered at home shall be registered and so protected in all the other states of the union, subject to refusal only if the object for which it is asked is considered contrary to good morals and to public order. (Art. 8.) The trade marks shall be protected in all the countries of the union without registration. (Art. 9.) That every production unlawfully bearing a trade mark or commercial name may be seized on importation into those of the states of the union in which such trade mark or commercial name has a right to legal protection. (Art. 10.) That seizure shall be applicable to products bearing falsely the name of a stated locality when this shall be joined to a fictitious commercial name or a name borrowed with a fraudulent intention. (Art. 11.) That protection shall be accorded to trade marks and trade names at international expositions. (Art. 13.) That an international bureau shall be established at Berne.

Foreseeing the probable desirability of revision, it was provided in Art. 14 that "The present convention shall be submitted to periodical revisions for the purpose of introducing improvements calculated to perfect the system of the union. With this object, conferences shall take place successively in one of the contracting states between the delegates of said states. The next meeting shall take place in 1885, at Rome."

* A paper read before the New York Board of Trade and Transportation October 15, 1897, by Francis Forbes.

The conference at Rome was duly held, the United States being represented by Mr. Stallo, United States minister to Italy.

The principal amendment proposed was an addition to Art. 10, that every product bearing a false indication of origin should be seized on importation into any one of the contracting states; and that the seizure might also take place before shipment or after importation. Also for temporary protection of inventions, designs and models appearing at international expositions.

These propositions were not ratified by all of the contracting states, and therefore failed.

The United States adhered to the convention in 1887 and under an act of Congress (26 Statutes at Large, page 17) sent three delegates, Hon. Thomas W. Palmer, minister to Spain, and Messrs. F. A. Seeley and Francis Forbes, to the succeeding conference at Madrid in 1890.

The conference at Madrid, because of the failure of the propositions of the conference at Rome to receive universal assent and to be incorporated into the convention, adopted the expedient of subsidiary conventions and unions, which have gone into effect between the several powers which have agreed to them only.

There are two of these subsidiary conventions, both signed at Madrid April 14, 1891, viz.: One for the suppression of false indication of origin, i. e., the seizure of all goods bearing any mark indicating a place of manufacture or production other than the true place. Such goods are to be seized in the country of production, on importation into another state, or in the latter state, or, in case the laws of any state do not permit of seizure, such other remedies are to be taken for repression as are allowed by the laws of that country. (The latter clause was added at the suggestion of the delegates from the United States.)

Art. 3 permits the vender of goods coming from another country to indicate his name and address, but in that case the address or the name must be accompanied by a clear indication in legible characters of the country or place of manufacture or production.

The following nations have adhered to this subsidiary convention: Brazil, France, Great Britain, Portugal, Spain, Switzerland and Tunis.

The other subsidiary convention provides for the international registration of trade marks, to which Brazil, Belgium, France, Italy, Netherlands, Portugal, Spain, Switzerland and Tunis have adhered. Also Austria-Hungary, with a proviso of legislative ratification.

International registration under this agreement is a purely diplomatic affair. The citizen of a government adhering to the union applies to his government to register his mark for him at the International Bureau at Berne, and the bureau in turn forwards such mark for registration to the other states of the union. The fees are only those of the various governments, and in addition an almost nominal fee for the International Bureau. The registration being thus made is freed from any of the risks attendant upon the work of making separate registrations in the separate countries.

The convention of Paris of March 20, 1883, for the protection of industrial property is of the greatest importance to trade mark owners in the United States, since it makes provision for the time in the growth of their several businesses when they will overflow national bounds and become international.

Without any international agreement and with each government acting according to supposed local interest, the same trade mark might be used in many different countries, with the result of limiting the trade of each user of the mark to certain geographical bounds.

An example of what we mean recently appeared in the Belgium Trade Mark Journal, which publishes officially all registrations. In vol. 9, at page 42, occurs a statement of the registration of the trade mark "Okonit" for an insulating compound for electric cables, etc., by a German firm. Now, "Okonite" is a well known trade mark here for the same article, and is registered at the Patent Office in Washington.

Another example is that of two prominent starch manufacturers, one of whom has a trade mark registered and long in use in this country, but little trade abroad. His rival has commenced to use the mark in England but not here, and has applied for registration there, which is being opposed. It is said that, if the registration is granted to the applicant in England—who does not use it here—he can stop the manufacturer here from shipping to England. This is not an enviable condition for a future expansion of the trade of the originator of the mark.

These examples show the serious nature of the question of international registration, and of treaties to protect marks in their international relations.

A third conference under the convention has been called to meet at Brussels, Belgium, on December 1, 1897. This conference is held in France to be of such importance that numerous propositions for the amendment of the convention have been forwarded (according to newspaper reports) to the various chambers of commerce throughout the republic for their opinion. It should awaken the liveliest interest in our own manufacturers and merchants, also expressed through their boards of trade and chambers of commerce.

It is to be observed that the convention for the protection of industrial property contains the following article:

"Art. 15. It is understood that the high contracting parties respectively reserve the right to make, separately, between themselves, special arrangements for the protection of industrial property so far as these arrangements shall not interfere with the provisions of the present convention."

The United States has made special treaties in regard to trade marks with the following nations: Austria, 1871; Belgium, 1884; Brazil, 1878; Denmark, 1892; France, 1869; Germany, 1871; Great Britain, 1877; Italy, 1882; Russia, 1874; Servia, 1881; and Spain, 1882.

We are not alone as a nation in our interest in foreign trade, as is demonstrated by the various treaties to which reference has been made. All history now points to the reaching out of the civilized nations toward the uncivilized in order to supply the latter with the refinements of civilization in exchange for raw products. We have heretofore been principally producers of these raw products, such as wheat and cotton. We are now, however, producers of manufactured articles requiring the highest skill; it behooves us, therefore, to enter vigorously into all movements which will protect not only the marks of our own citizens, but those of other countries similarly situated. By this co-operation we shall deal fairly and honestly with our neighbors, which fairness and honesty will redound to our own advantage as a nation.

NEW DEPARTURE CHEMISTRY.

By Dr. E. C. TOWNE.

IN the initial issue for the current year of The Electrical World, Prof. Elihu Thomson had an article entitled "Fuel Energy into Electrical Energy," and the editor of the publication referred to the article as treating of "the direct conversion of fuel energy into electrical energy," "electrical energy direct from the energy of fuel."

Prof. Thomson stated the problem as that of "how to obtain an increased efficiency or a greater percentage of the potential work of a fuel as electric energy." He spoke of the steam engine as effecting "the conversion of the potential energy of the combustible into electric energy," and referred to the claim made for the Jaques battery that "as high as 85 per cent. of the energy represented by the solid carbon is thus converted into electrical energy."

"Fuel energy," "potential energy of the combustible," "energy represented by the solid carbon," and "electricity direct from coal," means carbon which will do two things: (1) incandesce of itself by its own electricity, and (2) give off extra electricity. But the fact is that carbon is absolutely inert and passive, a fixed solid, and able to do nothing whatever of itself. These statements of Prof. J. P. Cooke's "New Chemistry," exceptional as they are, are perfectly correct:

"Carbon is peculiar in this respect: In all its conditions, whether of diamond, graphite or coal, it is one of the most fixed solids known. Even when exposed to the highest artificial heat it never loses its solid condition.

"Since carbon, in all its forms, is non-volatile, the molecules of the charcoal [burning in pure oxygen] cannot leave the solid lumps. They do not, therefore, go half way to meet the oxygen molecules, but simply receive those which are driven against the surface of the coals. Hence the process depends on the activity of the oxygen molecules alone.

"The glowing particles of charcoal [finely pulverized, made red hot and sifted into pure oxygen], after they have become incandescent, retain their solid condition until the last atom of carbon is consumed.

"The material of the burnt charcoal is taken up into the gas atom by atom, actually absorbed by it as a sponge absorbs water. Every molecule of oxygen which strikes against the charcoal flies off with an atom of carbon, forming with it the molecule of carbonic dioxide."

The oxygen molecule is one of two atoms, O-O, and this molecule becomes O-C-O, but the physics of the operation is probably not that of absorption, or as Mendeleef, greatest of modern chemists, says, a carbon atom squeezed in between the two oxygen atoms. It is far more likely that the carbon atom hangs upon the oxygen molecule $\begin{smallmatrix}O-O\\C\end{smallmatrix}$, and that, just as ozone, $\begin{smallmatrix}O-O\\O\end{smallmatrix}$, is three-atom oxygen, with the third atom hanging on to the molecule, but not wholly incorporated, so our CO_2, or $\begin{smallmatrix}O-O\\C\end{smallmatrix}$, is carbonized oxygen, with a purely oxygen history before it, in the relation of CO_2 to plant life.

But this apart. What I wish to say here is that the energy of combustion, or of any union of oxygen with a combustible like carbon, or any attack of oxygen upon carbon, is wholly oxygen energy and is not carbon energy at all, and that all getting of electricity direct from combustion of any kind is getting it from the oxygen.

The Chinaman who, after watching the action of the cable car, said, "No pushee, no pullee—go like mad," is quoted by Prof. Lodge as a philosopher, with this declaration: "Remember that, whenever we see a thing being moved, we must look for the rope. Unless there is either 'pushee' or 'pullee,' there can be no action. And if you further consider a pull, it resolves itself into a push [as the pull of a horse by pushing against the collar to which the pulling traces are attached]. We may make this general statement: The only way of acting on a body directly is to push it behind."—"Modern Views of Electricity," p. 391.

The push of steam in the piston gives the pull of the railway train, but the initial push is that of the oxygen of combustion as it pours into the engine fire. How that push of oxygen gas against the atoms of carbon fuel can have the tremendous efficiency required to push the engine and train is the problem which a railway train presents. It is evident that the direct forward push of the mass of oxygen cannot amount to anything. There must go with this some other push incalculably greater, and this can only be (waiving exact explanation) the push of the electrical charge of the oxygen.

The oxygen molecule, by reason of its electrical charge, has the necessary push, and if we are to read actions aright, we must invariably note this push of oxygen, and on no account suffer the conception of "attraction" to intervene. Instead of saying "intense affinity for oxygen," we must say energetic intensity of oxygen to unite with, to seize and hold fast, or to seize and carry away. So, also, if we note what action occurs in electrolysis, we must see electrical charge increasing the push of oxygen and throwing it back upon the anode. In the storage battery, oxygen electrical push is held in leash on the peroxide. It is a survival of the false "attraction" view which causes Thompson to ascribe "high chemical activity" to the hydrogenated lead, and to tell us that the cell does not store electricity, but rather stores energy in the form of chemical work. The energy is nothing else but the electrical charge of the oxygen of the peroxide. Electricity was driven into the peroxide, and the same electricity flows out again. It is oxygen push, at any rate, and it is hardly less plain that the push is electrical. "Chemical work" and "energy" mean nothing. We are using sound sense in seeing that oxygen push is the thing, and once that we see this, we may almost take for granted that this push is electrical. It is only dreadfully poor thinking which permits us to say that a cell which we have loaded up with electricity, and out of which we can get that same electricity, is not a storage-of-electricity cell.

And when we correctly note the electrical character of sun energy, we must also note that it is invariably related to oxygen, and not to carbon. If we remark the immense part played by the so-called carbonic dioxide in supplying, by way of entrance into their leaves, the chief substance of all plants, we must take care to see how the oxygen molecule and the sun co-operate. In the first place, pure oxygen is every moment the breath of life of the plant, precisely as of the animal; and it is by its own push that the oxygen beats into the protoplasm cells of the plant. It is not drawn in; not even in ourselves is it drawn in, for its entrance into the lung capillaries and the corpuscles of the blood; it pushes its own way; it alone is active; we are wholly passive; the whole of the driving energy of the animal system is oxygen push; the whole animation and order of vital movements in the plant is due to oxygen push; and no mistake can be greater than that of fancying that somehow the plant is run by sun energy apart from oxygen. Sun energy operates upon the oxygen and acts in the plant through oxygen.

Thus the oxygen which has come into union with carbon, each molecule of the oxygen carrying an atom of carbon, has its push intensified in sunlight; it pushes into the protoplasm cells of the leaves of plants, carrying its load of carbon; and the sun still augmenting its electrical intensity, it is helped to shake off its carbon and to push out into the air, with the wholly incidental result that the plant can use the carbon as food for its growth. The carbon benefits, and the plant, through the value of the carbon to it, benefits by the energy of the sun, but it is the oxygen of the carbonic dioxide on which the sun's ray especially act, helping it to push into the leaves of the plant, and then helping it to shake off its carbon load and escape into the air with fully restored intensity. Cooke states that oxygen and carbon combine in the proportion of 100 grains of oxygen to 37½ grains of carbon, and that every ton of coal burned yields 3⅔ tons of carbonic dioxide. That is to say, the work of burning a ton of carbon is done by 2⅔ tons of oxygen. The great new German steamship is said to have bunkers for 4,950 tons of coal. If the coal were pure carbon, this would mean 13,200 tons of oxygen to do the work intended by the amount stated of coal, and 18,150 tons of carbonic dioxide going off into the air through the carrying energy still left in the oxygen. It might serve a good purpose to give adequate attention to the tremendous weight of tremendously energetic oxygen implied by eight tons of oxygen to every three tons of carbon, and oxygen with carrying energy sufficient to keep its flight as a gas after every molecule has taken up an atom of the passive, inert carbon. "Lavoisier inferred," says Cooke, "that oxygen must be the chemical center in the scheme of Nature." Its electrochemical energy is what gives oxygen its supreme place. The driving energy of our fires and light-giving flames, and of all vital activity in both plants and animals, is the electrical charge carried by the oxygen of the air.

SEWING NEEDLES IN GERMANY.

THE sewing needle, though small, forms a very important article of commerce in Germany. While formerly England supplied that country with needles, this industry, according to the United States consul at Annaberg, has during the last few years developed to such an extent that the Germans are able to meet their English competitors, not only on the markets of the world, but in the British colonies and in England as well. The principal seats of the industry are Aix la Chapelle, Burtscheid, Iserlohn, Altona, Nuremberg, and Schwalbach. The factories of Aix la Chapelle alone produce 50,000,000 needles weekly. The following figures show to what extent the exports from Germany of these needles have developed. During the eight years from 1880 to 1887 the German export of needles of all kinds (embroidery, knitting, darning, sewing and sewing machine needles) amounted to 11,600,000 lb., of the value of £2,500,000. The following eight years make a still better showing. During this period the quantity exported was 15,000,000 lb., valued at £3,000,000. The enormous growth in the production of this article is due principally to the export trade to China, where Germany seems to entirely control the market. Other countries importing German sewing needles are British East Indies, France, the United States, Austria-Hungary, Italy and Turkey. In conclusion the American consul says: "Under the protection of their government the Germans have built up a needle industry which commands the respect of the world. At first they imitated the English methods of manufacture, but their superior technical training soon enabled them to discover the defects of the English machinery, and they adopted new and improved devices, and followed their own course of manufacture. The infant industry of a few years ago has become one of national importance. The manufacturers go into the markets of the world, preferably into new countries, and compete successfully everywhere."—Journal of the Society of Arts.

DANGER OF EXPLOSION AND FIRE IN THE MANUFACTURE AND STORAGE OF ALUMINUM BRONZE COLORS.

THE author observed repeatedly that the aluminum bronze colors became oxidized in the settling vessels to aluminum hydrate with evolution of hydrogen. The decomposition by water only took place if the temperature of the rooms in which were the settling vessels rose above 25° C. The evolution of hydrogen begins slowly, but in consequence of the heat of the reaction, becomes very vigorous. As there may be present in a settling vessel six kilos or more of the bronze color capable of evolving at least seven cb. m. of hydrogen, there is the possibility of a dangerous explosion by the formation of considerable quantities of inflammable gas in the rooms. By the admission of moisture and heat to packed aluminum bronze, evolution of hydrogen may take place, and if the packing material be inflammable, may lead to fire. Spontaneous combustion of aluminum bronze colors was also caused by friction or blows, due probably to small quantities of fat adhering to the powder. These phenomena were not observed with bronze colors made from copper zinc or copper tin alloys.—Zeits. Oeffentl. Chem.

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